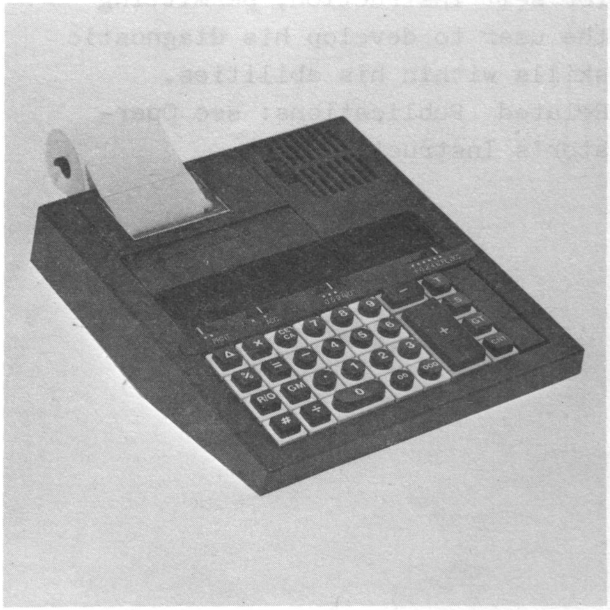
Logos
46 PD/48/49

General Service Manual



olivetti

Code 3961470 V (0)

PREFACE

This General Manual is intended for use by customer engineers and laboratory technicians, as well as dealer and agent repairmen. A technician who has previously worked on precise mechanical or electric products will encounter no difficulties in repairing these calculators. Previous electronic training, while helpful, is not required.

The manual includes all parts lists, service and repair guides, fault-finding guide and mechanical and electronic theory. It is written for self instruction, permitting the user to develop his diagnostic skills within his abilities. Related Publications: see Operator's Instruction Book.

References:

Booklet: Instructions

First Edition: August 1980

© 1980, by Olivetti

PUBLICATION ISSUED BY:

Ing. C. Olivetti & C., S.p.A.
Servizio Documentazione
77, Via Jervis - 10015 IVREA (Italy)

3961470 V

CONTENTS

1. INTRODUCTION 1-1

Technical Features 1-1

Operational Features 1-2

Disassembly of the Calculator 1-4

2. OLIVETTI SERIAL PARALLEL IMPACT PRINTER 2-1

Printer Theory 2-1

Printer Disassembly 2-13

Printer Reassembly 2-19

Printer Adjustments 2-20

Main Control Cam to Reset Shaft 2-20
Motor Adjustment 2-21
Motor Speed Adjustment 2-22
E3SLO Activation Bridge 2-23
Bobbin Support 2-25
Vertical Alignment 2-26
Print Density 2-26
Display Operation 2-27

Diagnostic Procedure 2-31

Power Supply Faults 2-31
Display Faults 2-31
Printer and Keyboard Faults 2-31
Faults related to the E.C.U. 2-31

3. FAULT FINDING GUIDE 3-1

Power Supply 3-1

Voltage Checks, Logos 48-49 3-3

Voltage Checks, Logos 46 3-5

Printer Faults 3-7

Mechanical Printer Faults 3-7
Electronic Printer Faults 3-8
Magnetic Rubber Verification 3-8

Keyboard Faults 3-9

Keyswitch Verification 3-9
Selector Slider Verification 3-9

Connection Faults 3-10

Keyboard Intervention 3-11

Display Faults, Logos 46 3-11

Display Faults, Logos 48/49 3-12

A. TECHNICAL APPENDIX A-1

Logic Board Layouts A-1

Electronic Components List A-2

Wiring Schematic Logos 48 & 49 A-3

Wiring Schematic Logos 46 A-4

Circuit Analysis A-5

R.E.D. Procedures A-19

Power Supply Faults A-21

Motor Circuit Faults A-22

Electronic Display Faults A-22

MOS/LSI Device Open-pin Faults A-23

General Test, LOGOS 46PD, 48, 49 A-24

B. UNIT PARTS LIST B-1

Cover B-3

Transformer B-4

Printer B-5 ÷ B-7

Keyboard B-8

L.46 Board B-9

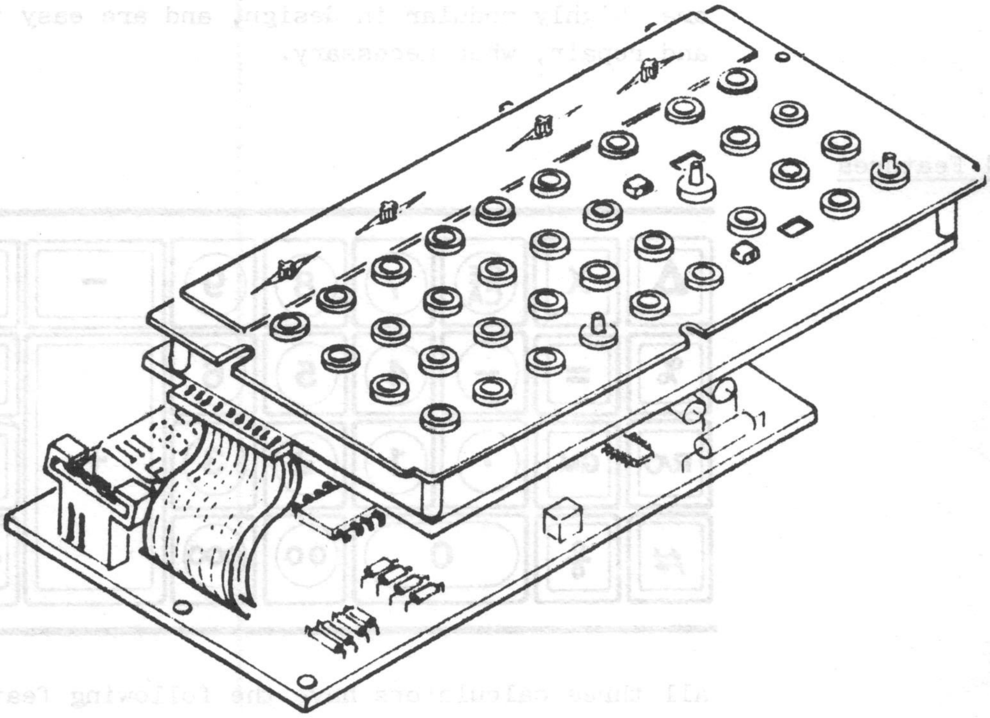
L.48-49 Board B-11

Recommended Part List B-12

1. INTRODUCTION

Technical Features

The LOGOS 46, 48 and 49 are application-oriented calculators of a new class. Each calculator has a 13-position display, and the Olivetti Serial Parallel Impact Printer. The logic board is designed so that one MOS/LSI device performs the functions of CPU, ROM/RAM and I/O. The logic board includes IC drivers for the motor circuit and the individual coils (or "bobbins") of the printer.



Keyboard

Machine Dimensions:

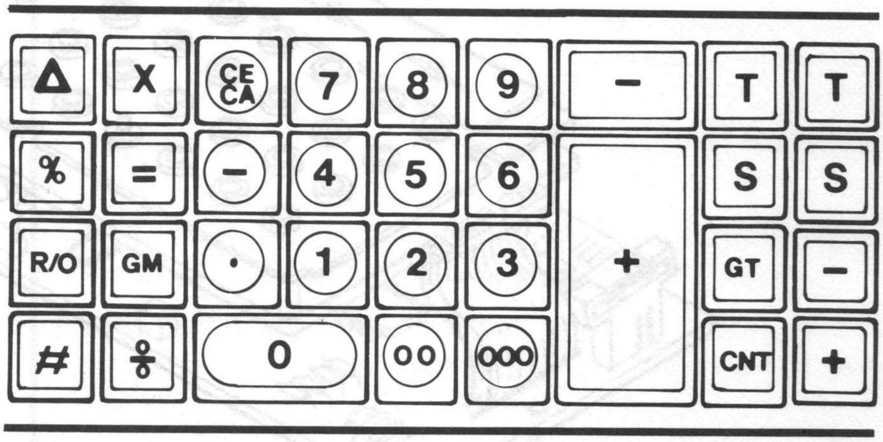
width : 224 mm
height: 80 mm
depth : 250 mm
weight: 1.8 kg.

Supplies: The calculator uses a paper tally roll and ribbon cartridge, both available from sales.

The machines use two printed circuit boards: the logic board itself and one within the keyboard module. They are connected electronically by flexible ribbon cable connectors.

A single molded housing contains the selector sliders, the key switch assemblies, and the printed circuit board. A new key switch design uses a conductive rubber pad and a molded rubber spring. The calculators are highly modular in design, and are easy to service and repair, when necessary.

Operational Features



All three calculators have the following features in common:

- one working register consisting of add, subtract, sub-total and total
- two-key "program" or touch-mode function
- multiplication
- division

- percentage calculation with automatic mark-up or mark-down

- delta

- twelve digit capacity in entry and total including decimal and sign

- constant multiplier or divisor

- thirteen-position display

- memorization of last printed item, which can be used for another immediate operation ("natural constant")

- chain multiplication and division

- pre-selection of decimals: floating, six, four, two zero or suppressed decimals, and add-mode

- automatic accumulation (GT register)

- non-print if desired

- selectable round-off of 0.5 or 9

- keyboard buffer

- non-add

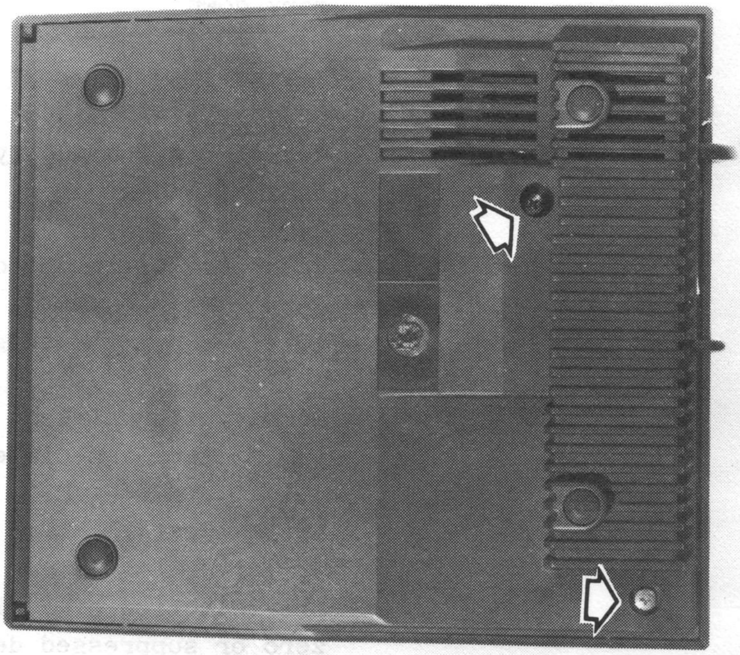
- jump totals/results

- key command item counter with automatic averaging

- single key (CE:CA) for keyboard clear and machine reset.

The LOGOS 49 has additional features: time in/time out (clock) and day/date (calendar) functions; an additional working register of add, subtract, subtotal and total; parametric round-off, and gross margin functions.

Disassembly of the Calculator



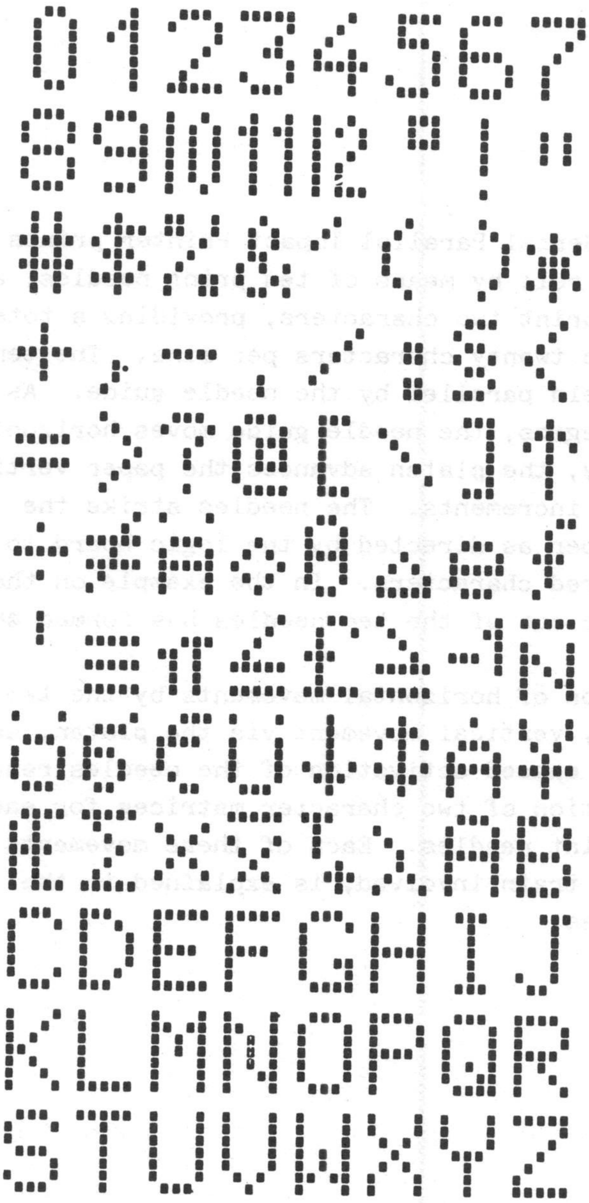
Remove the two case screws as shown. Remove the selector sliders by pulling straight up. Disengage the molded lugs near the transformer by prying gently between the upper and lower cases. Lift the rear of the upper case while holding the keyboard in position. Disengage the molded lugs at the front corners of the case, and set aside the upper case. Printer and keyboard are positioned by case design. Transformer and logic board are secured by screws. Always be careful of the flexible connectors.

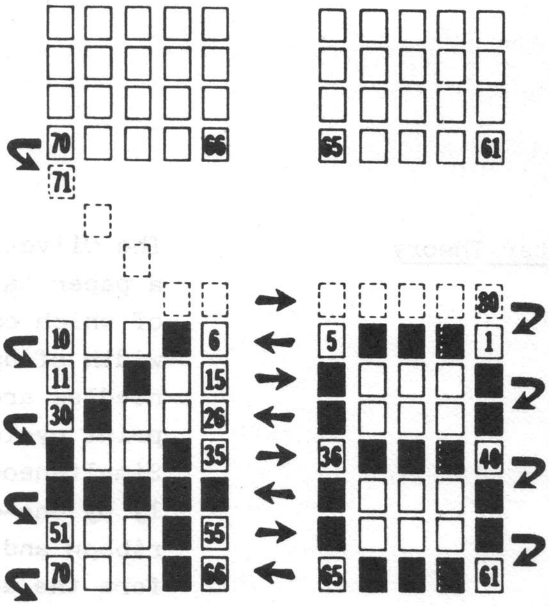
2. OLIVETTI SERIAL PARALLEL IMPACT PRINTER

Printer Theory

The Olivetti Serial Parallel Impact Printer prints on a paper tally roll by means of ten print needles, each of which can print two characters, providing a total width of up to twenty characters per line. The ten needles are held parallel by the needle guide. As the print cycle begins, the needle guide moves horizontally. Simultaneously, the platen advances the paper vertically by one-dot increments. The needles strike the ribbon and paper as directed by the logic board to form the desired characters. In the example on the following page one of the ten needles has formed 48.

The combination of horizontal movements by the ten print needles, vertical movement via the platen, and appropriately spaced activation of the needles results in the generation of two character matrices for each of the ten print needles. Each of these movements, and the power train involved, is explained in the following pages.

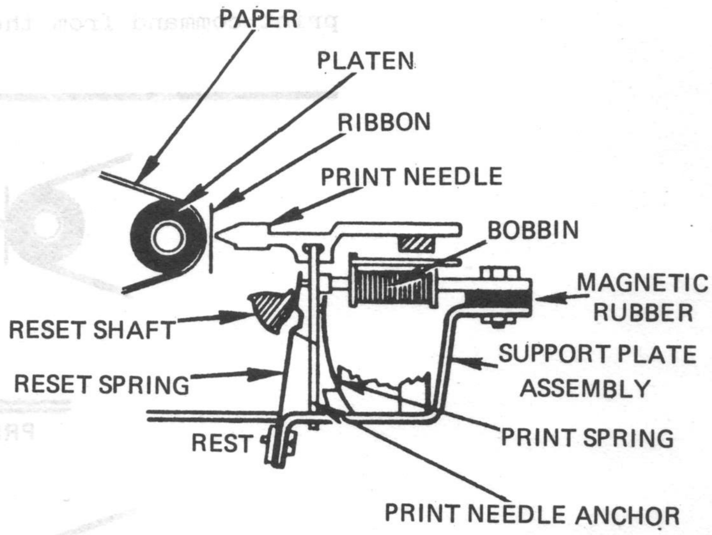




70
66
65
61
71
80
10
6
5
1
11
15
30
26
35
36
40
51
55
70
66
65
61

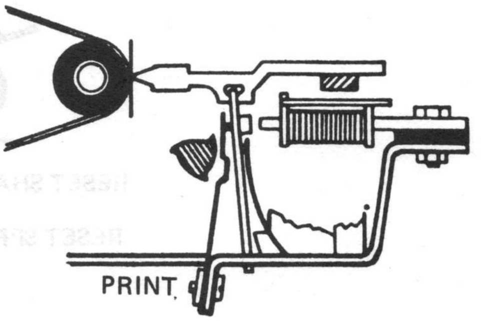
The print head consists of ten needles, located in front of the paper, in the upper part of the printer. One end of each needle is located by a slot in a fixed support. The printing end is located in the corresponding slot of an oscillating support (needle guide) placed in front of the ribbon. This oscillating support provides the horizontal movement of the needles over two character positions.

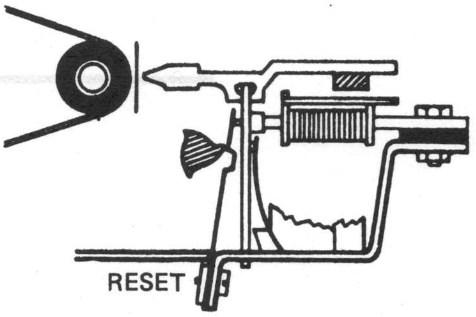
Prior to printing, the entire mechanism is at rest. In this position, each needle is held away from the platen by its respective anchor. The anchor is held against its respective bobbin by a permanent magnetic field, produced by magnetic rubber, through the bobbin support, anchor, and the support plate assembly.



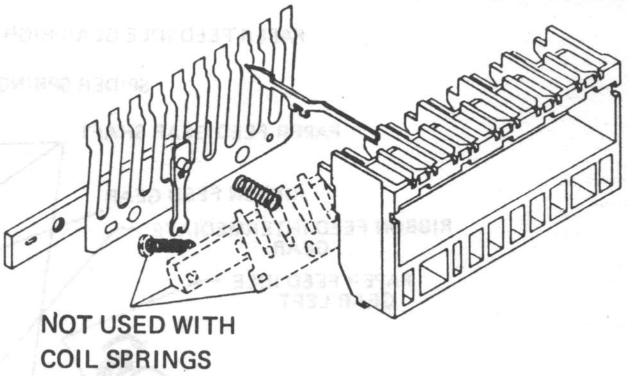
When a print cycle begins and the print needle is required to print, the control electronics (E.C.U.) first must start the motor and then, at the appropriate dot positions, energize the bobbin. This will momentarily interrupt the magnetic field holding the print needle anchor. Since the force of the print spring is greater than that of the reset spring, the print needle will strike the inked ribbon, causing a dot to be printed on the paper.

The reset shaft rotates while the motor is running, and one of its lobes will push against the reset spring, which resets the print needles and anchors. The solenoid has since been de-energized by the control electronics, and the restored magnetic field will hold the anchor and the print needle in place after the lobe of the reset shaft moves away from the reset spring. The needle is immediately ready for another print command from the control electronics.

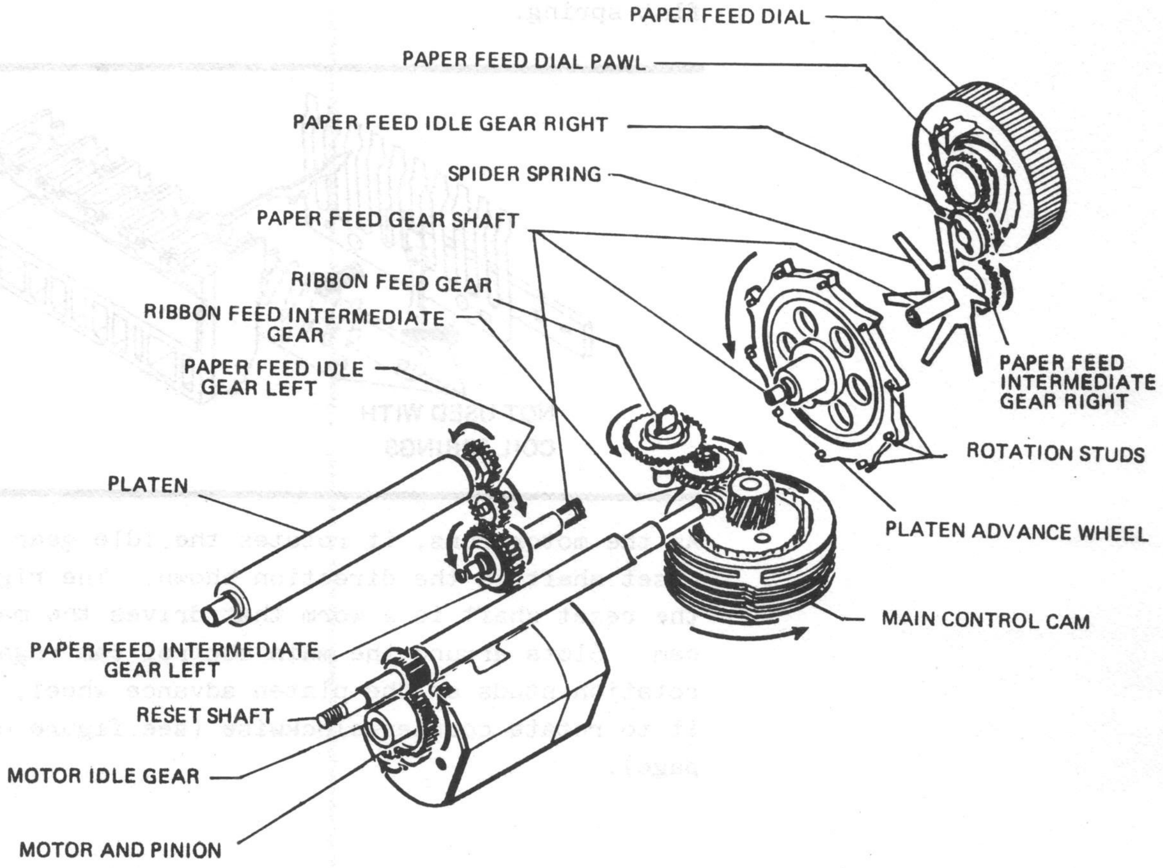




Coil Spring Option: Printers may be equipped with ten individual coil print springs instead of the single flat spring.

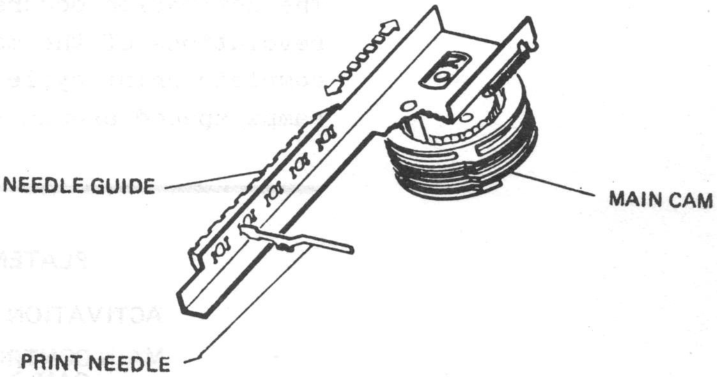


As the motor runs, it rotates the idle gear and the reset shaft in the direction shown. The right end of the reset shaft is a worm that drives the main control cam. Slots around the main control cam engage the rotation studs on the platen advance wheel, forcing it to rotate counter-clockwise (see figure on next page).

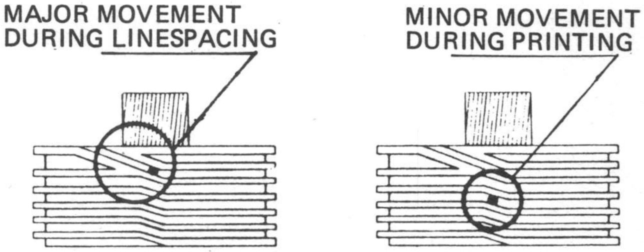


On the other side of the platen advance wheel, driving lugs engage the spider spring, so that it rotates in the same direction. The spider spring acts as a clutch to allow manual paper feeding. The spider spring is keyed to the paper feed shaft, and it also rotates counter-clockwise. On the left end of this shaft is the paper feed intermediate gear, which drives the platen, via the idle gear. This is the mechanism by which the paper is advanced upward while printing and line-spacing.

The horizontal movement of the print needles, and the vertical feeding of the paper are provided by the main control cam which is driven by the motor via the worm on the right end of the reset shaft. The main control cam moves the needle guide from side to side by means of an eccentric cam slot on top of the main control cam, which engages the follower stud on the needle guide. This slot on the main control cam is designed to provide the horizontal spacing between each dot column as well as the spacing between each character column. The inner profile of the track assures that, during the printing of each dot, the needle guide is temporarily stopped to obtain good print quality.



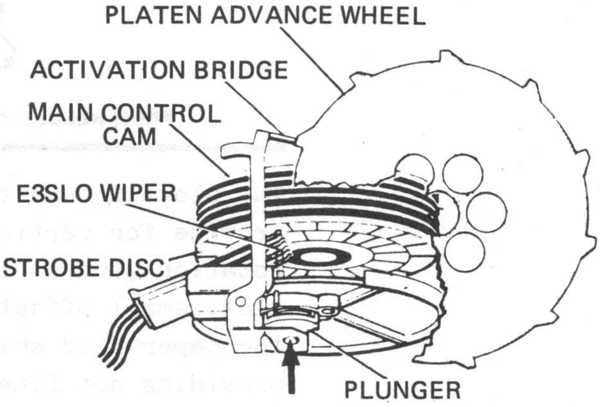
The slots around the outside of the main control cam provide for vertical spacing between lines. As the rotation stud on the platen advance wheel follows the slot, small offsets cause minor movement which, via the paper feed shaft and gears, rotate the platen providing dot line spacing. The large offset at the upper end of the slot provides character line spacing. As one rotation stud leaves the upper end of the slot, another stud enters the slot at the bottom. Thus, at any given moment, there is one rotation stud in mesh with the main control cam.


MAJOR MOVEMENT DURING LINESPACING
MINOR MOVEMENT DURING PRINTING

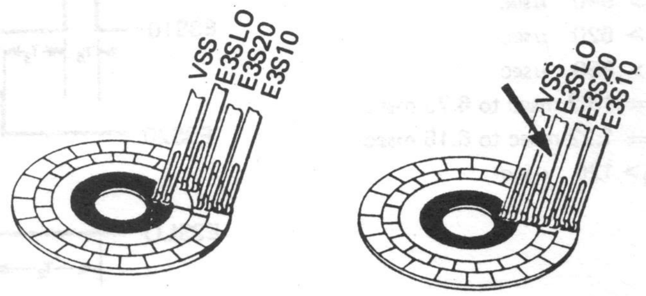
On the bottom of the main control cam is a strobe disc with four circular tracks. Four brush contacts (wipers) are held against these circular tracks. When the cam is rotating, these wipers send strobe signals to the control electronics.

During a print cycle, all wipers are held in continuous contact with the circular tracks except for track 3, E3SLO. The wiper of track 3 is mechanically phased with the platen advance wheel such that, exactly at the end of a vertical spacing cycle, it is brought into contact with its track. This is accomplished by an activation bridge.

The activation occurs only once in eight complete revolutions of the main control cam: this equals one complete print cycle. The activation is caused by the ramps spaced around the platen advance wheel.



This shows the positions of the E3SLO wiper. Left, the wiper is clear of the strobe disc, as it would be during most of the print cycle. Right, it is in contact with the strobe disc in preparation for contact with the E3SLO track. This position indicates to the control electronics that the platen, platen advance wheel, print needles, main control cam, and strobe disc are in correct position to start printing. Therefore, the control electronics should command printing after receiving the E3SLO signal.

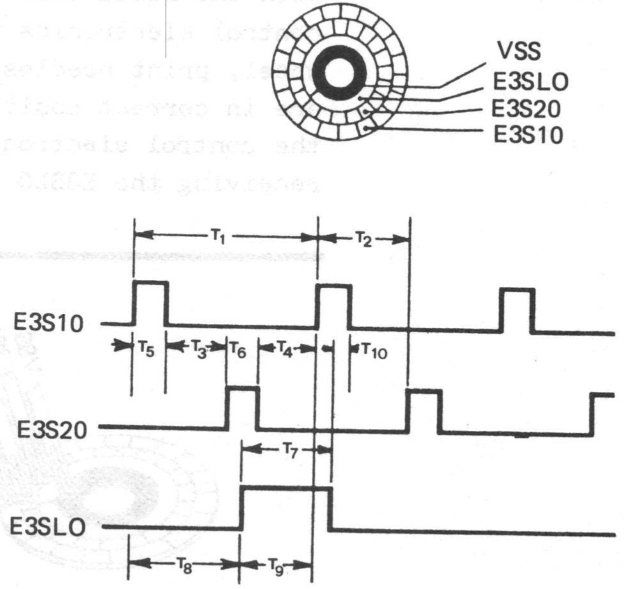


The printer motor is a DC motor that operates at from 15 to 23 volts. The motor/printer combination is characterized at the time of assembly into seven ranges corresponding to the motor voltage value required to provide approximately 1.8 lines per second print speed. These characters and their corresponding nominal voltages are shown in the accompanying table.

Character	Nominal Voltage
A	15.3
B	16.3
C	17.3
D	18.6
E	19.7
F	21.2
G	22.9

The strobe disc of the printer sends three signals to the control electronics. These signals are: E3S10, E3S20, E3SLO.

$T_1 = 5$ msec to 10.4 msec
$T_2 = 1.53$ msec to 5.76 msec
$T_3 > 120$ μsec
$T_4 > 120$ μsec
$T_5 > 540$ μsec
$T_6 > 620$ μsec
$T_7 > 950$ μsec
$T_8 = 1.62$ msec to 6.75 msec
$T_9 = 1.22$ msec to 6.15 msec
$T_{10} > 120$ μsec



E3S10 This is the dot print request signal for each dot in the matrix, and is generated continuously as the strobe disc rotates. This strobe is guaranteed to be active for more than 540 microseconds. The time between the leading edges of two consecutive strobes can be as short as 5 milliseconds and as long as 10.4 milliseconds, depending upon the absolute printer speed.

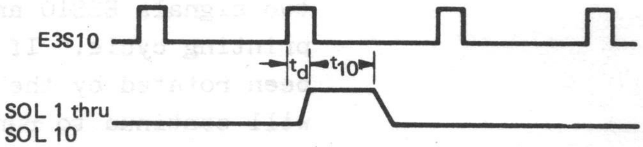
E3S20 This signal is generated continuously between each two dots, and is used to reset the state caused by the preceding E3S10. This signal (E3S20) also indicates that the control electronics should begin looking for the next E3S10 signal, in order to print the next dot. Non-overlap between E3S10 and E3S20 is guaranteed for a minimum of 120 microseconds. E3S20 is guaranteed to be active for a minimum of 620 microseconds. Time between the leading edges of two consecutive E3S20 signals can be as short as 5 milliseconds and as long as 10.4 milliseconds, depending upon the absolute speed of the printer.

E3SLO This signal is generated at the beginning of each print cycle. After this signal as occurred, the control electronics should be prepared to receive the first E3S10 signal in order to print the first dots of each of the ten right-hand characters of each needle.

E3SLO is guaranteed to be active for a minimum of 950 microseconds. As overlap between E3S10 and E3SLO, or E3S20 and E3SLO, will occur. However, a delay between the trailing edge of E3SLO and the trailing edge of the first E3S10 signal is guaranteed to be at least 120 microseconds. Also, during continuous printing, a delay between the leading edge of the 80th E3S10 signal and the leading edge of the E3SLO signal is guaranteed to be a minimum of 1.62 milliseconds.

The three strobe signals are generated by a contact closure to a fourth common line. Timing relationships between the three signals are shown on page 2-10.

The control electronics send the following signals to the printer in order to print dots: SOL 1, SOL 2, SOL 3, SOL 4, SOL 5, SOL 6, SOL 7, SOL 8, SOL 9, SOL 10. These signals are used to energize the solenoids of the corresponding print needles. In order to print dots, these signals must start at each leading edge of E3S10 with a maximum delay of 120 microseconds and must last for a minimum of 1 millisecond to a maximum of 1.25 milliseconds. The timing relationship between E3S10 signals and the solenoid signals is shown in the following figure.



$t_d \leqslant 120\ \mu\text{sec}$

$t_{10} = 1 \text{ to } 1.25 \text{ msec}$

Each solenoid draws a maximum peak current (Ip) of 540 milliAmps. The maximum average current used by each solenoid (Iav) is 250 milliAmps, for a period of 1.25 milliseconds. Therefore, to print a line of twenty digits continuously (character "8" assumed), the maximum average current can be calculated as follows:

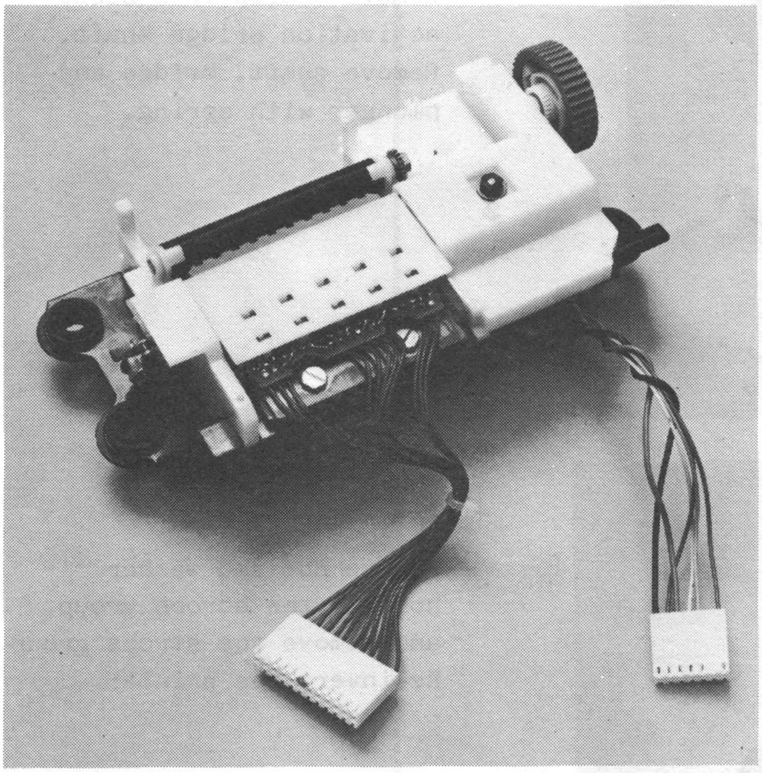
$$10 \times 250 \times \frac{1.25}{6.25} \times \frac{340}{800} = 212.5 \text{ milliAmps}$$

continuous where 10 is the number of needles. 250 is the maximum average current per dot, 1.25 is the dot time in milliseconds and 6.25 is time between dots, 340 is total dots used per cycle and 800 is total dot positions available per cycle (including those which occur during line-spacing).

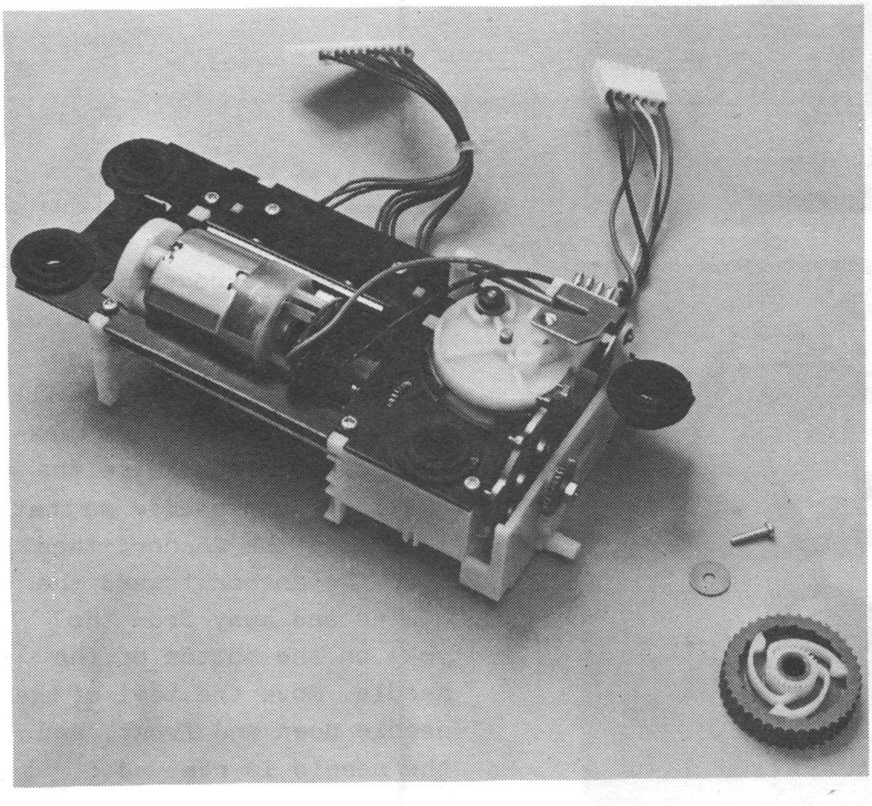
When printing is required, the control electronics start the motor. After the motor has been turned on, the control electronics should wait for the E3SL0 signal in order to start looking for the first E3S10 signal. If, at the time the motor is turned on, E3SL0 is already active, the control electronics must wait for the next leading edge of E3SL0 prior to detection of the first E3S10 signal. When the E3S10 is detected, the control electronics should energize the necessary solenoid within 120 microseconds in order to print dots in the correct positions in the required matrices. At the same time, a counter should be incremented to indicate that one of the dots per needle is printed. Now the control electronics should wait for E3S20. After E3S20 has occurred, the control electronics should start looking for the next E3S20. After 70 E3S10 have been counted, the required line of print is completed. The control unit must wait for the 71st E3S10 to remove motor power and apply dynamic braking.

In some cases the printer may run a little longer than usual. This is because the E.C.U. must receive the two signals E3S10 and E3SL0 in order to start normal printing cycle. If the E3SL0 activation bridge has not been rotated by the platen advance wheel, the motor will continue to run until the E3SL0 activation has taken place and signal E3SL0 has occurred as previously described.

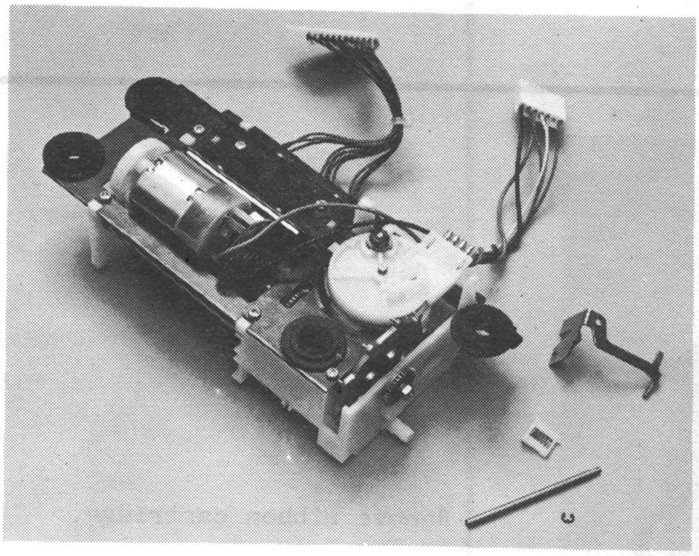
To understand the printer fully, rotate it by hand so that the theory and operations can be seen. On the left side of the printer is the knurled end of the reset shaft. This has been provided so the technician can easily rotate the reset shaft and thus operate the printer by hand. To do this, turn the reset shaft clockwise as you look as the left side. NEVER turn the reset shaft counter-clockwise, as this will damage the printer. The printer can be left in any rotated position, as when it is reinstalled, it will operate normally.



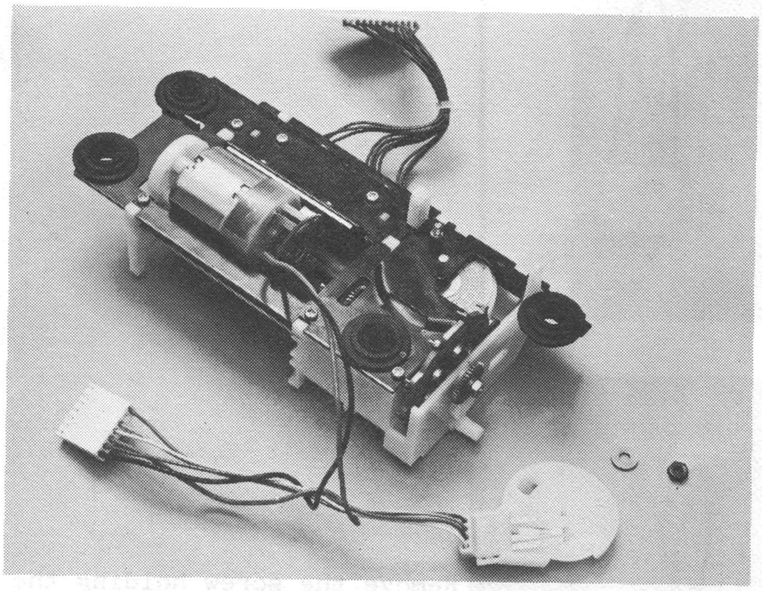
Remove ribbon cartridge.



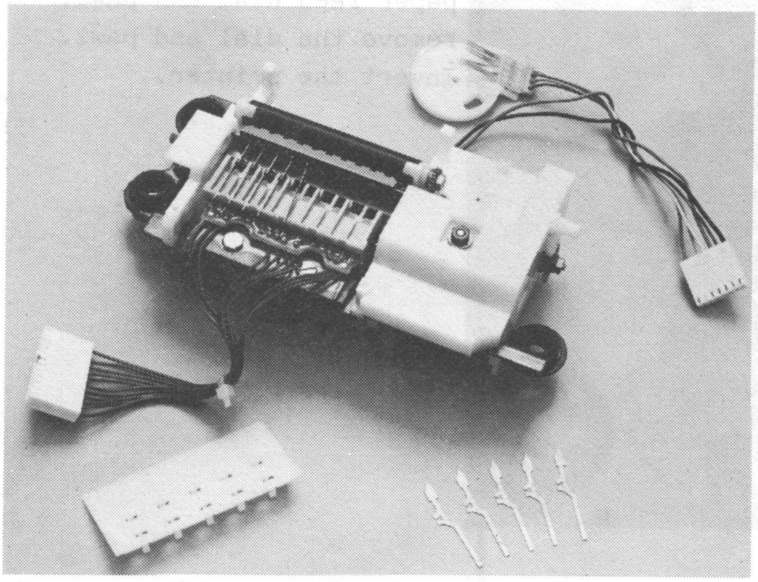
Remove the screw holding the paper feed dial and pawl; remove the dial and pawl. Invert the printer.



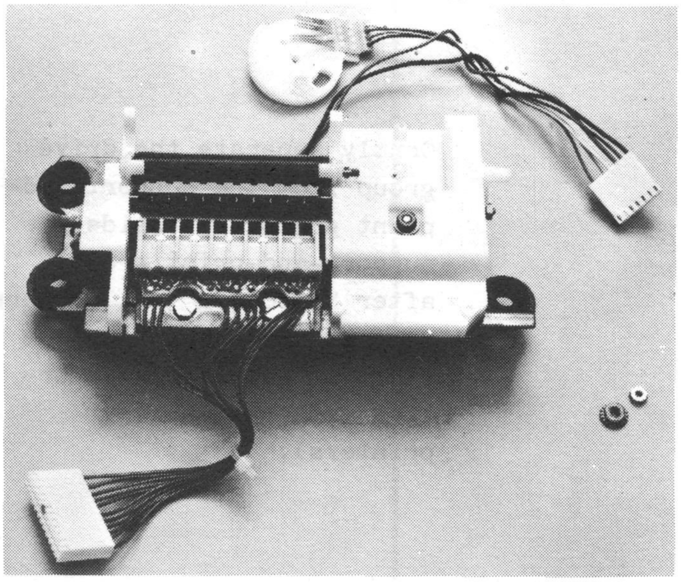
Remove C-clip from E3SLO activation bridge shaft. Remove shaft, bridge and plunger with spring.



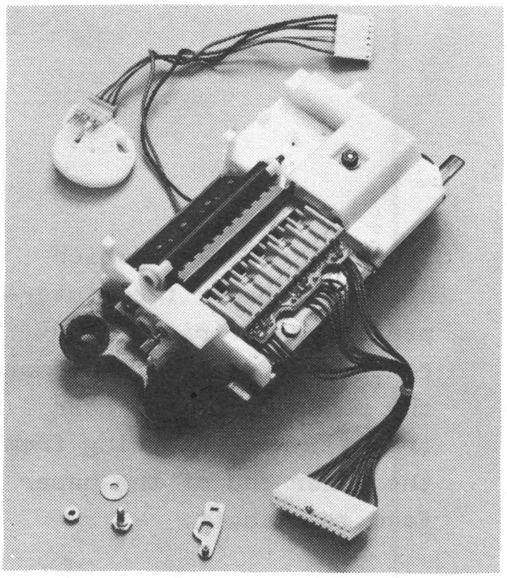
Remove nut and washer holding the strobe group, and remove the strobe group. Re-invert the printer.



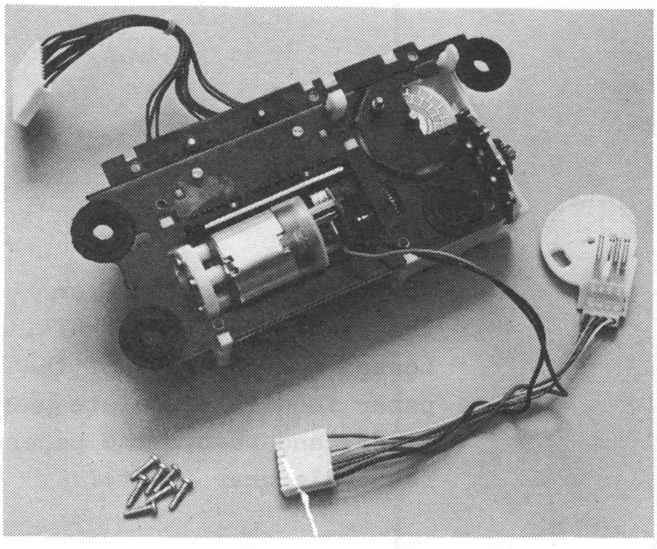
Remove needle cover, and print needles as follows: rotate the reset shaft so that one of its "flats" will face the reset springs (maximum clearance). Raise the "tail" of the needle so that it clears the anchor, then move the anchor toward the platen and away from the yoke on the bottom of the needle. Move the tail of the needle down and front, and the needle is removed.



Remove the platen drive gear nut and the gear.

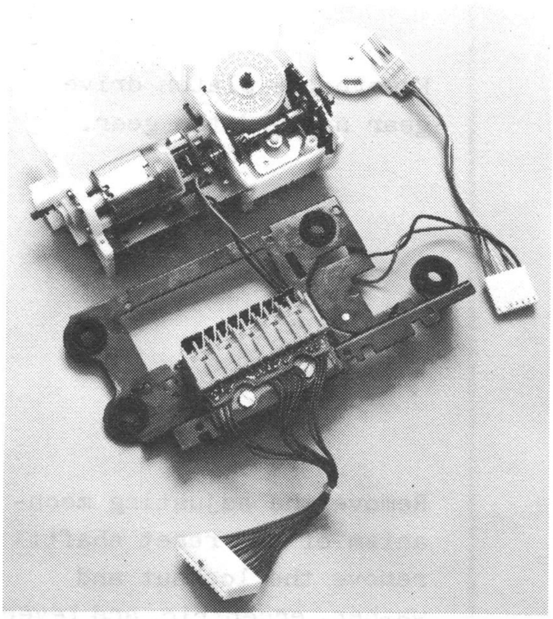


Remove the adjusting mechanism of the reset shaft: remove the locknut and washer, eccentric, and lever.

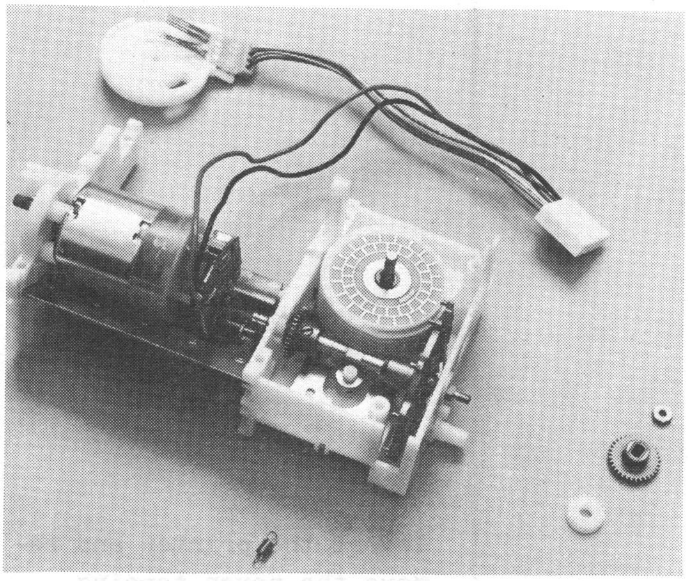


Invert the printer and remove the seven tapping screws securing the left side-wall and the right housing to the support plate.

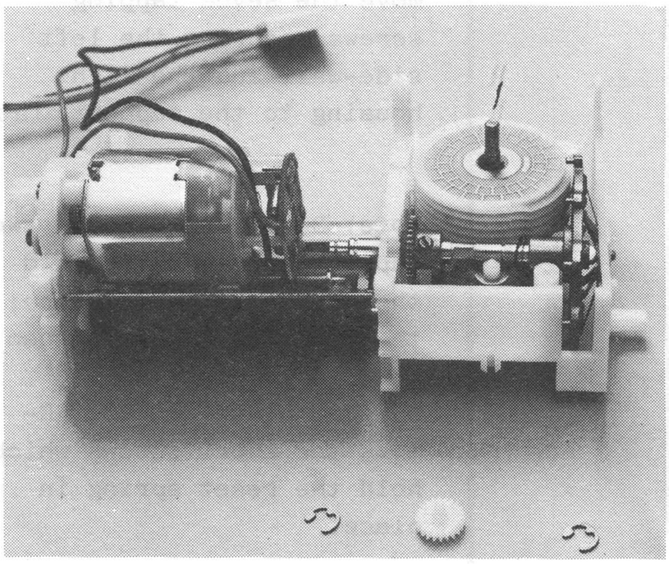
Note: DO NOT REMOVE the two tapping screws which hold the anchor guide in place; the printing mechanism can be left in place on the support plate. DO NOT REMOVE the short screws which hold the reset spring in place.



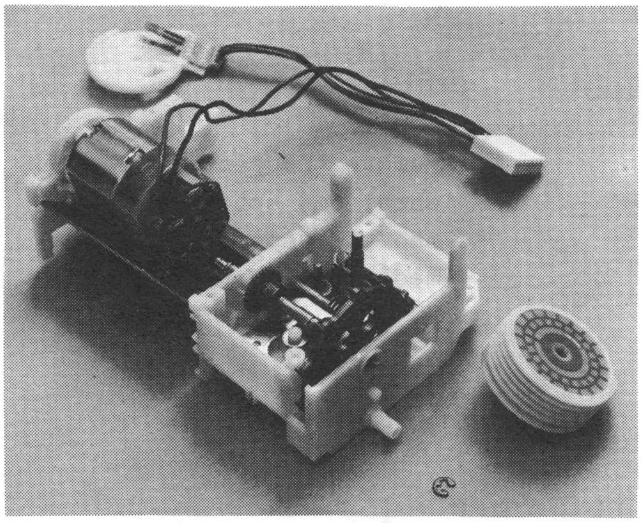
Gently separate the drive group from the support-and-print group. Set aside the support-and-print group, after "latching" all anchors against the bobbin support (this is especially important with coil spring printers).



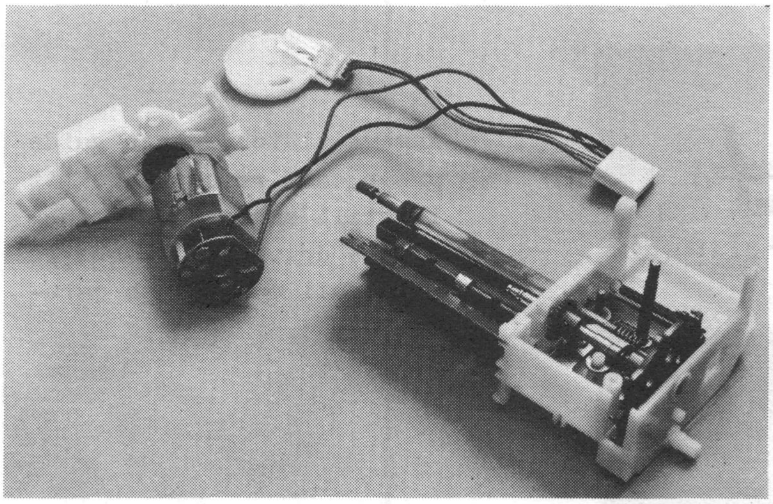
Remove the locknut which holds the paper feed intermediate gear (right) and remove the gear; also remove the paper feed idle gear (right). Remove spring from the other end of the paper feed gear shaft.



Remove both C-clips from the paper feed gear shaft. Loosen the setscrew of the paper feed intermediate gear (left) and remove the paper feed idle gear (left).

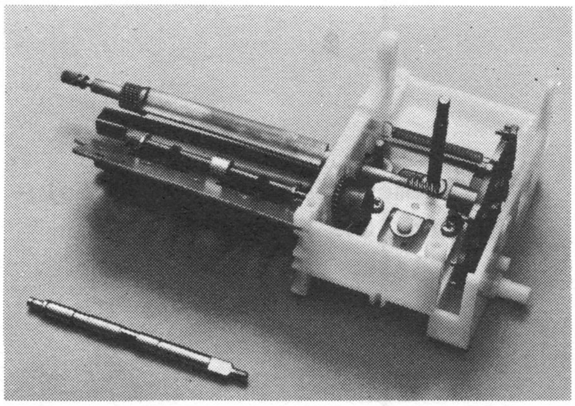


Remove C-clip from shaft of the main control cam and lift out the cam.

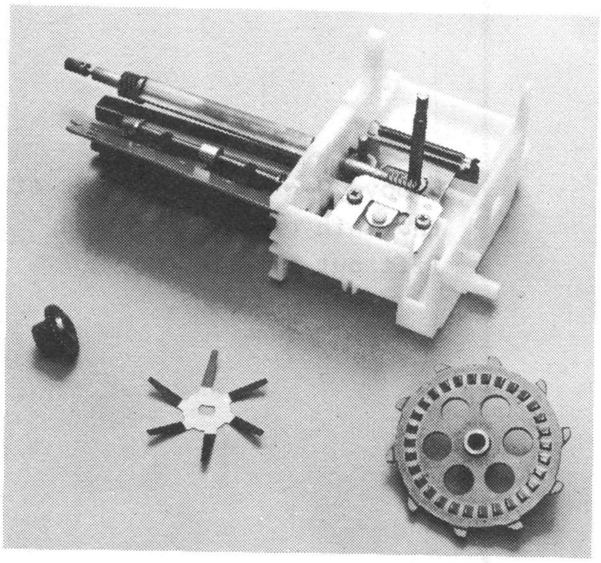


Separate the left outer sidewall with motor, connector and strobe group.

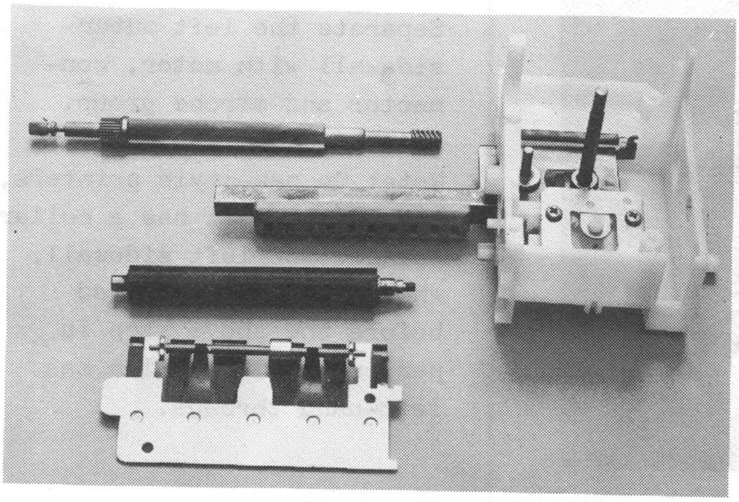
Note: On new-style printers, the reset shaft has a collar outside the left sidewall, which must be unscrewed before the above step is performed. The collar has left-hand threads.



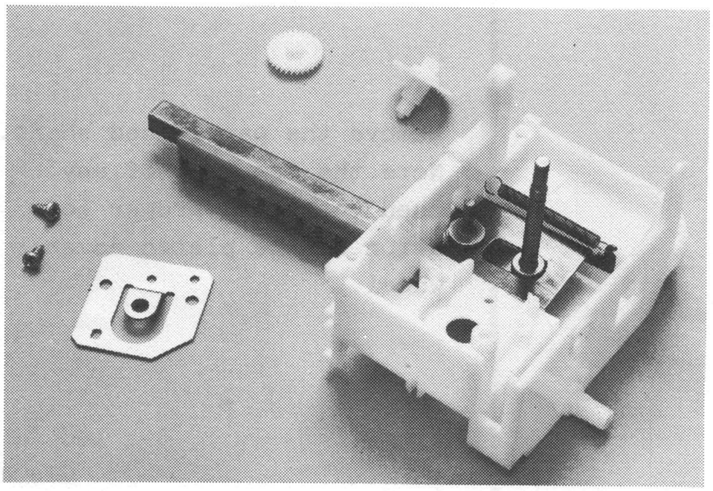
Remove the paper feed shaft. Note the spacers, if any, used to obtain proper location of the platen advance wheel.



Remove the platen advance wheel and spider spring, and the paper feed intermediate gear (left).



Remove platen, paper guide group, and reset shaft (it is still engaged with the ribbon drive train, but it will pull out; do so carefully).



Remove the two screws holding the ribbon feed gear plate, and lift out the plate and the two gears.

Printer Reassembly

Begin with the right housing, inverted.

1. Insert ribbon feed gear, intermediate gear, and the plate. Install two screws.

2. Place the spider spring, platen advance wheel and paper feed intermediate gear (left) in the housing, in their approximate positions; insert the paper feed gear shaft, threaded end first. Be careful with the spider spring: it is keyed to the shaft by "flats". Install C-clips (and any spacer noted during disassembly).

3. Place the paper feed idle gear (left) in its slot; tighten the setscrew of the paper feed intermediate gear (left) so that the shaft is free to rotate without end play. Be sure that the idle gear is in place before proceeding.

4. Install the paper feed idle gear (right) and the paper feed intermediate gear (right) and secure with its locknut. Check for free rotation, and be sure the idle gear is retained by the intermediate gear.

5. Install main control cam and C-clip; be sure the clearance between main control cam and platen advance wheel is from .2 to .7 mm.

6. Install the platen and platen drive gear (check for proper mesh with idle gear) and secure with locknut.

7. Insert the reset shaft: it must engage the ribbon feed gear train and the main control cam, so rotate the shaft while inserting.

8. Install the paper guide group so that the springs curl around the platen.

9. Install the left sidewall-and-motor group onto the above assembly. Guide the reset shaft, needle guide, platen and paper guide into their respective openings in the left sidewall. Install the collar of the reset shaft (left-hand threads). Install the spring on the left end of the paper feed gear shaft.

10. Combine the above assembly with the support-and-print group; the strobe group and connector must be lowered through the opening in the support plate first. Be sure the sidewall extension tabs are located correctly, and secure with the seven tapping screws, putting the star washer in its original place.

11. Install the reset shaft adjusting mechanism; first the lever, then the eccentric screw, then the washer and nut. Make the assembly snug in mid-range for later adjustment.

12. Install the strobe group and secure it with washer and nut: snug nut in mid-range for later adjustment.

13. Install E3SLO plunger with its spring (plunger is keyed to prevent improper insertion), E3SLO activation bridge and shaft. Secure with C-clip.

14. With printer right-side-up, install the print needles by reversing the procedure used for removal. Be sure all the anchors are properly seated in support plate. Install needle cover.

15. Install paper feed dial and pawl, and secure with tapping screw.

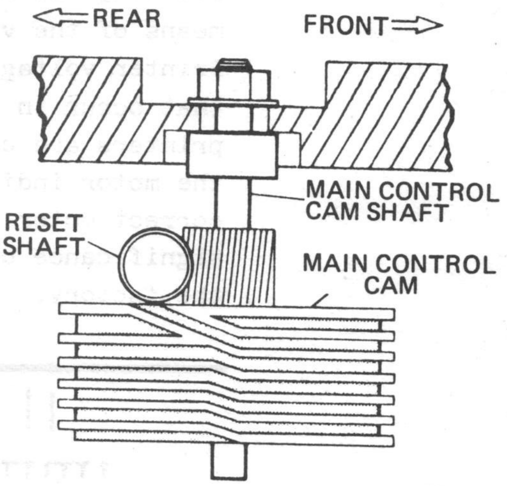
16. Install ribbon cartridge and perform all printer adjustments.

Printer Adjustments

Main Control Cam to Reset Shaft

This adjustment is required after replacement of either the main control cam or the reset shaft.

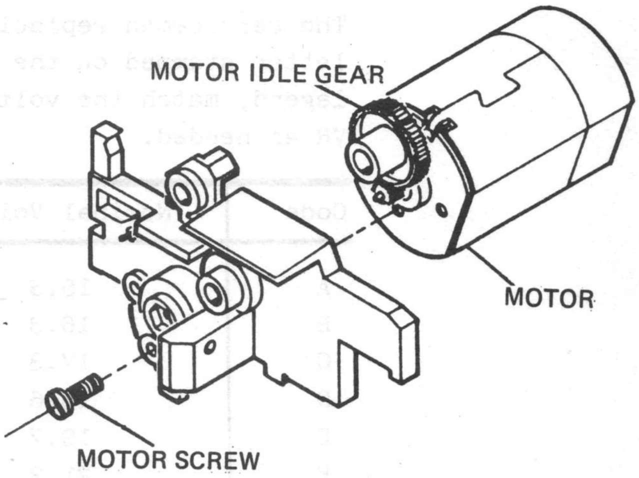
The mesh between the main control cam and the reset shaft must be as deep as possible without binding. To obtain this condition, loosen the nut on the main control cam shaft and move the shaft to the front or rear as necessary, then tighten the nut on the shaft. Verify the adjustment by rotating the printer by hand through a complete revolution of the main control cam (seven revolutions of the reset shaft) to reveal any binding between the reset shaft and the main control cam.



Motor Adjustment

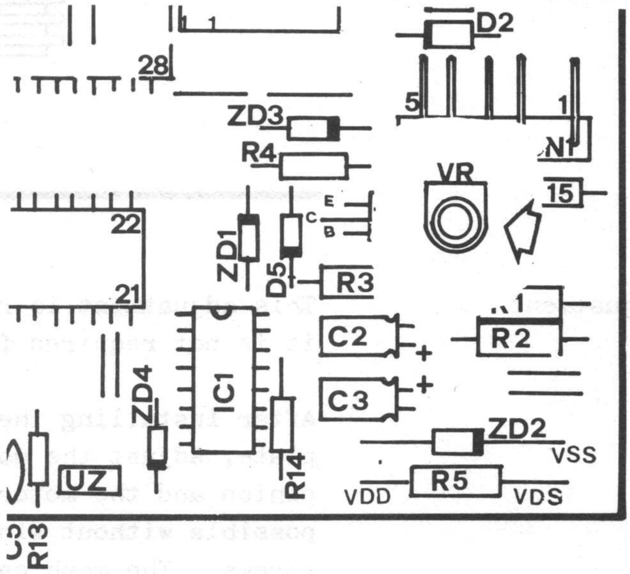
This adjustment is required after replacing the motor; it is not required following disassembly.

After installing the motor to the left outer side plate, adjust the motor so that the teeth on the motor pinion and the motor idle gear mesh as deeply as possible without binding, then tighten the three motor screws. The mesh can be observed through the inspection hole in the left outer side plate.



Motor Speed Adjustment

The speed of the printer is determined by the voltage reaching the motor. This voltage can be adjusted by means of the variable resistor VR on the logic board. Printer voltages need adjustment because of variances that occur in manufacturing. All factory-assembled printers are coded with a letter located on or near the motor indicating the voltage that will provide correct motor speed. Below is a legend showing the significance of the letter placed on the printer at the factory.



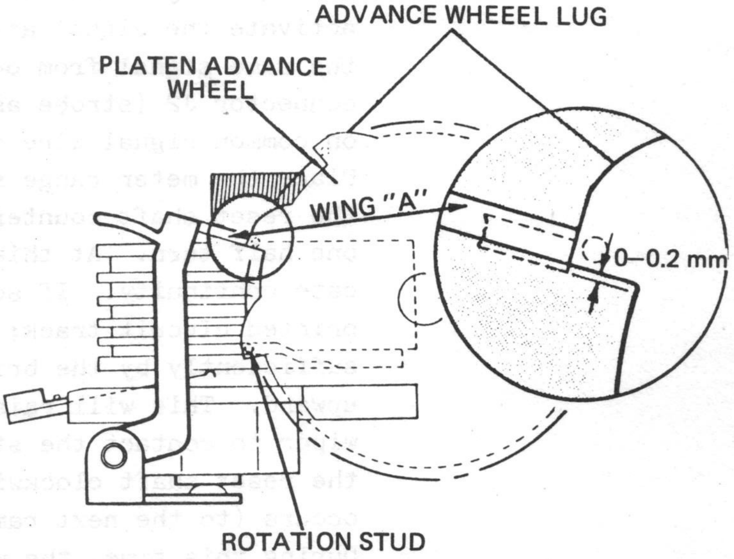
If the original motor on the printer was stamped "A", it requires 15.3 Volts for proper print speed; if it was stamped "B", it requires 16.3 Volts; and so on. The serviceman replacing the printer must note the letter stamped on the motor, and by following the legend, match the voltage to the motor by adjusting VR as needed.

Code	Nominal Voltage
A	15.3
B	16.3
C	17.3
D	18.6
E	19.7
F	21.2
G	22.9

E3SLO Activation Bridge

This adjustment is required after replacement of the strobe disc, strobe contact assembly, main control cam, activation bridge or plunger, or any other repair that may disturb the adjustment of the components.

First, rotate the printer by hand using the knurled end of the reset shaft until a rotation stud on the platen advance wheel is in the first groove of the main control cam as shown in the figure.



In this condition, wing "A" of the activation bridge should be even with, or slightly overlapping the platen advance wheel ramp by a maximum clearance of 0.2 mm. To obtain this condition, form wing "A". Once this adjustment is obtained, do not rotate the printer until the next adjustment.

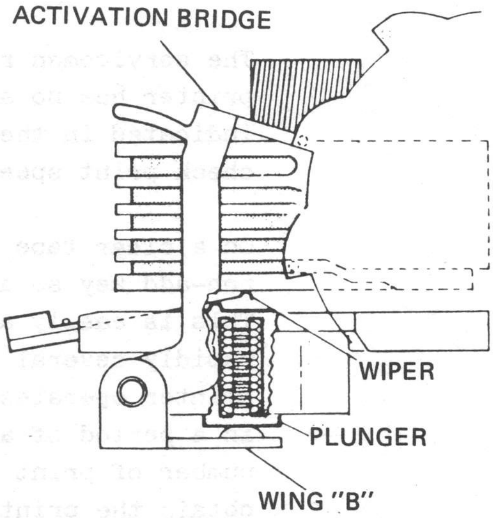
The serviceman replacing the motor in the original printer has no such guide, except the relative speeds indicated in the legend. Reassemble the printer and check print speed as follows.

On a clear tape enter some numerals and depress the non-add key so as to operate the printer continuously. This is easily accomplished by depressing the key rapidly several times, then at the same rate as the printer operates. Count the number of print cycles in a period of at least ten seconds, then divide the number of print cycles by the number of seconds to obtain the print speed in lines per second. Print speed should be close to 1.7 lines per second. As long as print quality is good, any speed between 1.5 and 1.9 lines per second is acceptable.

If a reassembled printer is notably slower than the range indicated above, the serviceman should check all lubrication points involved in the reassembly, and especially the mesh of the motor pinion and the idle gear, and the reset shaft adjustment.

The next adjustment ensures that the bridge will activate the signal at the correct time and prevent the same signal from occurring during printing. On connector J2 (strobe assembly) insert one meter probe on common signal wire and the other probe on E3SLO. Place the meter range switch on Rx1 scale. Now rotate the reset shaft counter-clockwise (backwards) about one half turn. At this point, the meter should indicate continuity. If so, the wiper has contacted the printed circuit track; if not, the wiper was not moved sufficiently by the bridge. Form wing "B" slightly upward. This will raise the plunger and cause the wiper to contact the strobe disc correctly. Now turn the reset shaft clockwise (normal) until line-spacing occurs (to the next ramp of the platen advance wheel). During this time, the wiper must not contact the strobe disc (the meter should not show continuity). If it does, form wing "B" slightly down.

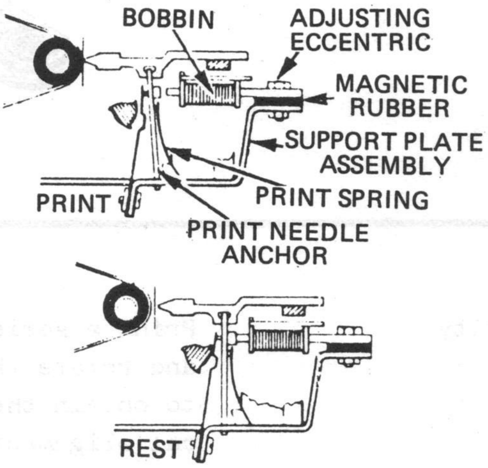
Note: This adjustment is the only occasion when the printer is turned backwards.



Bobbin Support

This adjustment will be required after replacement of the magnetic rubber, bobbin assembly, or bobbin support.

The distance from the print needle anchor to the bobbin support must be adjusted to ensure that the reset shaft will restore the anchor far enough to the front that it will contact and be magnetically held by the bobbin and bobbin support. To obtain this condition, rotate the adjusting eccentrics so that the reset shaft restores the print needles to the bobbin support but does not exert excessive pressure on the reset spring during reset, as it may slow the motor or damage the reset spring. Also keep in mind that this adjustment can affect print density.

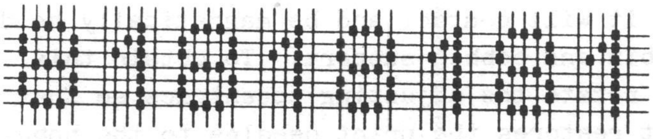


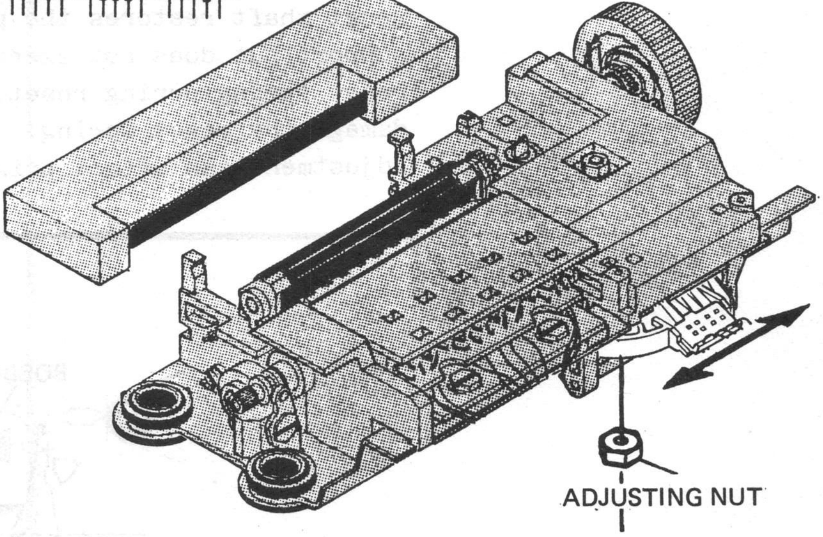
Note: When replacing the magnetic rubber between the support and the bobbin support, be sure to insert the rubber in the correct position. The cutout must be to the right and facing the front of the printer. Incorrect insertion will reverse the polarity of the magnetic field, and when the bobbins are energized they will reinforce the field instead of interrupting it: no print will occur.

These two adjustments are interrelated and should be checked together.

Vertical Alignment

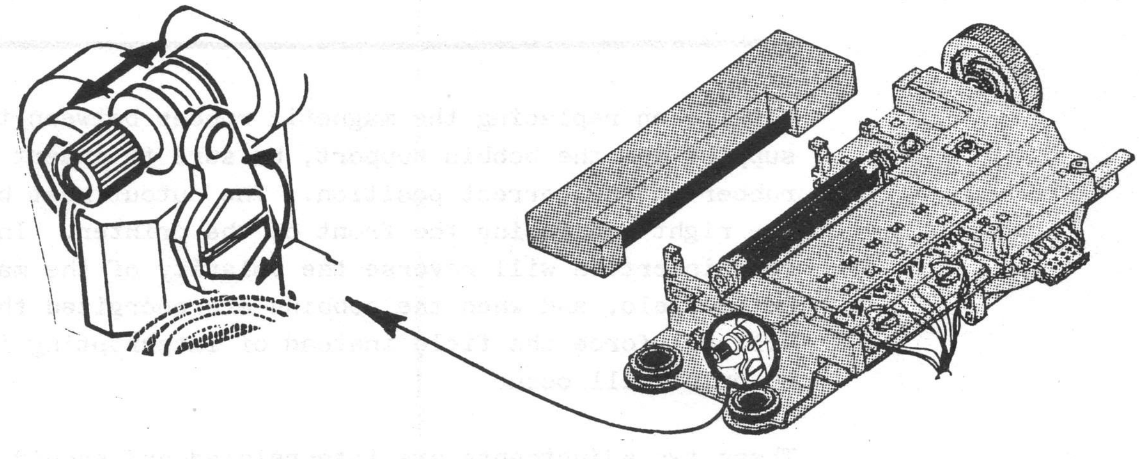
Print a series of eights and ones. Loosen the nut and rotate the strobe contact assembly left to right. Center the assembly in the range where the dot alignment is good on both sides of all characters. Tighten the adjusting nut on the strobe contact assembly.





Print Density

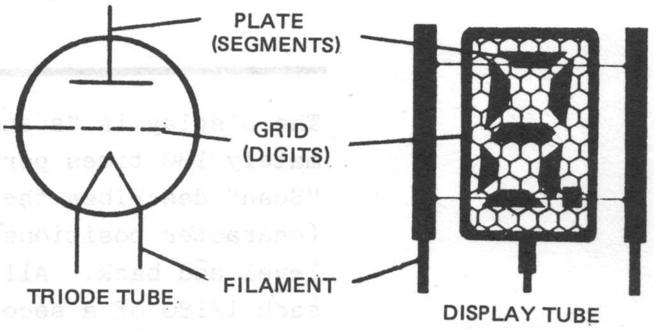
Print a series of eights and ones, loosen the locknut and rotate the adjusting eccentric for the reset shaft to obtain the darkest possible printing. Check vertical alignment adjustment. Tighten locknut at optimum setting.



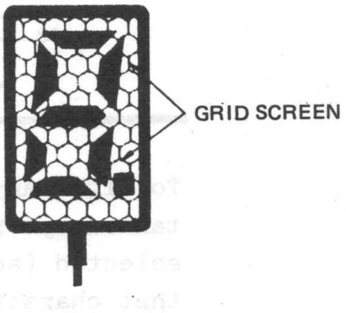
Display Operation

The display is a vacuum tube, similar to a triode, with the individual segments of the characters being the plate. The plates have a phosphur coating similar to a TV tube, so that they will light when bombarded by electrons from the filament.

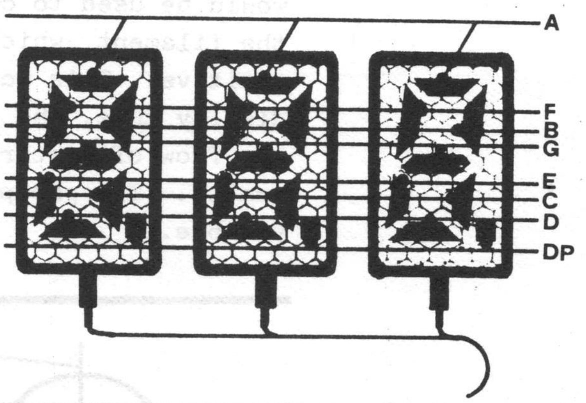
In the triode tube the negative voltage of the grid would be used to control the flow of electrons from the filament, which is negative, to the plate which is positive. This would cause the plate to light. In the display tube, the grid will either allow or prevent the flow of electrons to the individual plates (segments). The phosphur coating makes the display highly visible.



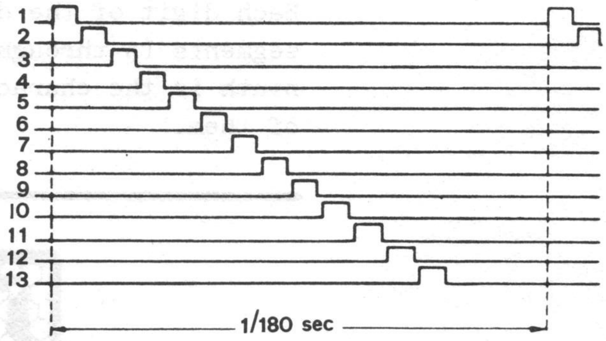
Each digit of the display tube has nine parts: eight segments (A through G, plus the decimal point) and the ninth is the character grid screen, located in front of them.



The segments and the grid screens are connected to the external leads of the display tube by conductive tracks. All thirteen similar segments are connected: all A segments are connected, all B segments, etc., as shown. The grid screens for the separate characters are not connected; they are controlled individually.

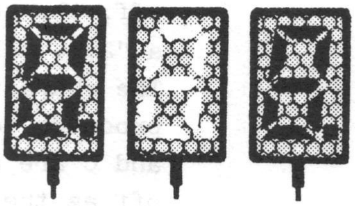


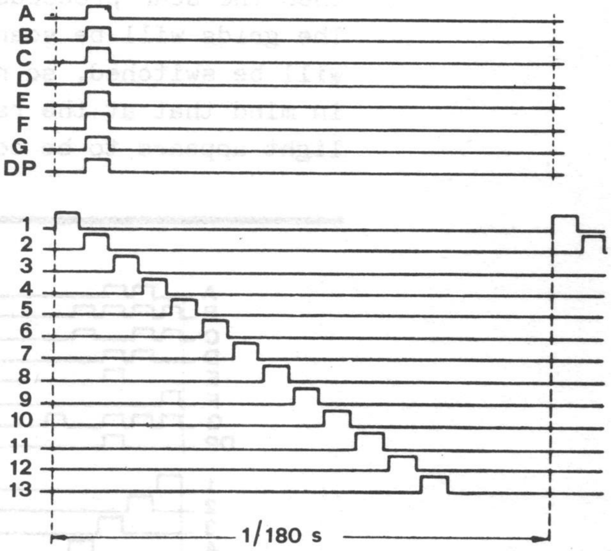
The display is "scanned" from right to left approximately 180 times per second as illustrated here. "Scan" describes the sequential switching of digits (character positions) from display low level to high level and back. All thirteen positions are scanned each 1/180 of a second.



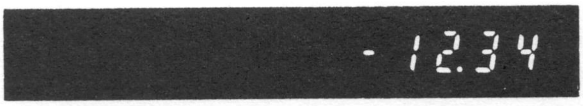
To light any character, two things must occur simultaneously: first, the character position must be selected (scanned), and second, the segments to form that character must be selected. Assume an "eight" with decimal point (8.) is to be displayed in the second character position of the tube. The MOS device will begin to scan at the first character position (right) and scan toward the left. As the second character position is reached, notice that the segments A, B, C, D, E, F, G and DP have been switched.

Because the grid and the segments are switched simultaneously, the figure "8." will appear at the second position. Keep in mind that this occured in a fraction of 1/180 of a second. Immediately the segments begin to darken, but in the next 1/180 of a second, the MOS device will perform the same operation. To the eye, this light appears to be constant. The process is called multiplexing.

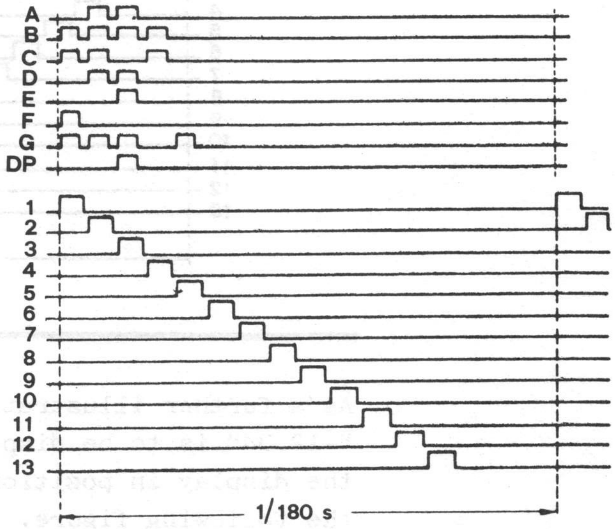




As a further illustration, assume that the entry "-12.34" is to be displayed in the extreme right of the display in positions one through five as shown in the following figure.

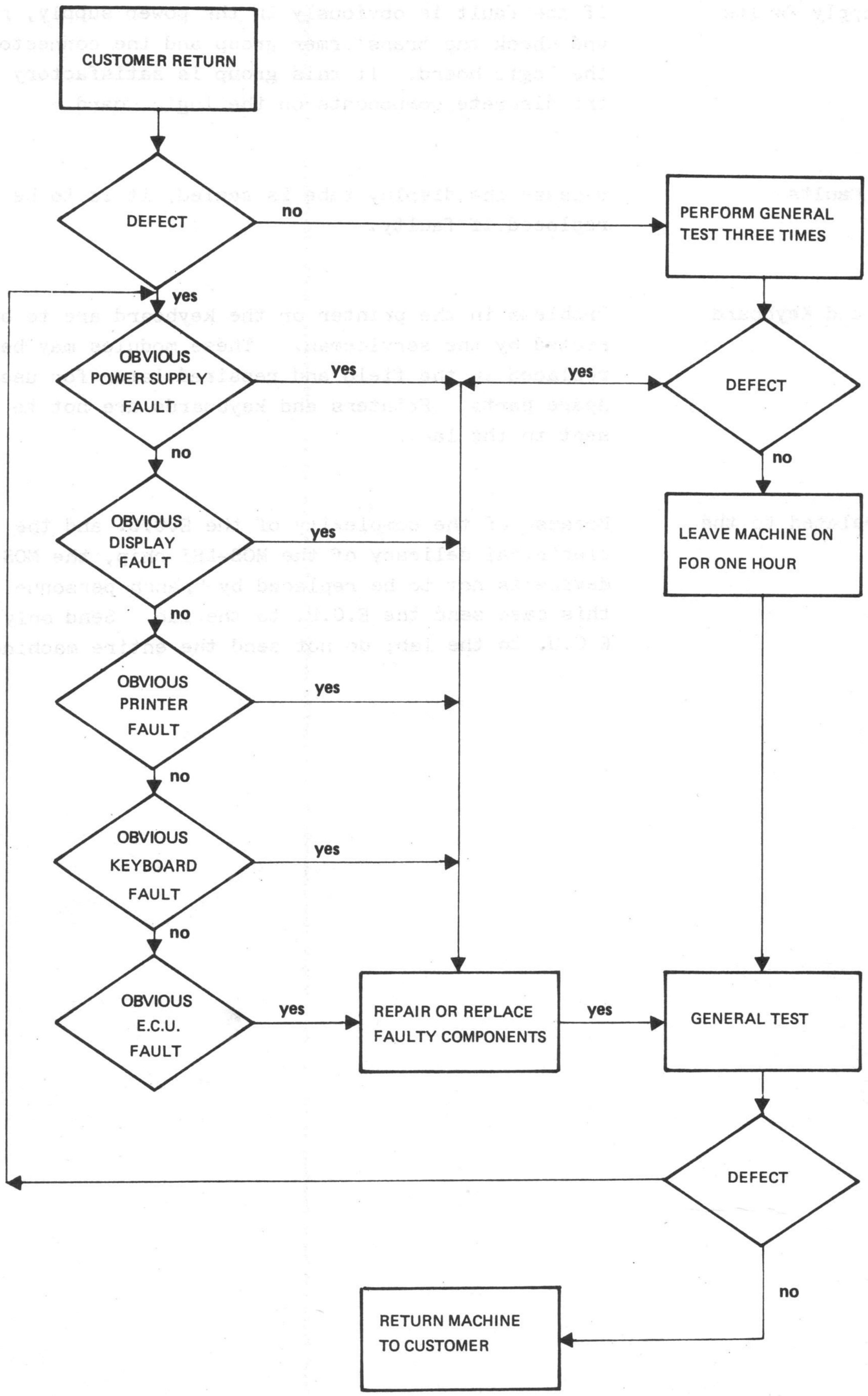


Recall that the display is scanned 180 times per second, right to left (or least significant digit to most significant digit). Considering just one scan of the entry "-12.34" at position One the MOS device will determine that a character is to be formed. It will switch the gridas usual, and it will switch the B, C, F and G segments to form a "4". At the second position, a "3" is required, so segments A, B, C, D and G are switched, forming a "3". As this character is switched off, the scan proceeds to the third position to form a "2.". All segments except C and F must be switched. The character lights, then is switched off as the scan proceeds to position Four to form a "1". Segments B and C are switched along with the grid, then switched off as the scan proceeds to the fifth position to form a minus sign: segment G. The minus sign will light, then the scan proceeds to the remaining positions. The grids will be scanned as usual but no segments will be switched, so no characters will light. Keep in mind that at the rate at which this occurs, the light appears to be constant.



Diagnostic Procedure

Power Supply Faults	If the fault is obviously in the power supply, remove and check the transformer group and the connector to the logic board. If this group is satisfactory check the discrete components on the logic board.
Display Faults	Because the display tube is sealed, it is to be replaced if faulty.
Printer and Keyboard Faults	Problems in the printer or the keyboard are to be corrected by the serviceman. These modules may be replaced in the field and repaired later for use as spare parts. Printers and keyboards are not to be sent to the lab.
Faults related to the E.C.U.	Because of the complexity of the E.C.U. and the electrical delicacy of the MOS-LSI chip, the MOS device is not to be replaced by branch personnel. In this case send the E.C.U. to the lab. Send only the E.C.U. to the lab; do not send the entire machine.


CUSTOMER RETURN
DEFECT
no
PERFORM GENERAL TEST THREE TIMES
yes
OBVIOUS POWER SUPPLY FAULT
yes
yes
DEFECT
no
no
OBVIOUS DISPLAY FAULT
yes
LEAVE MACHINE ON FOR ONE HOUR
no
OBVIOUS PRINTER FAULT
yes
no
OBVIOUS KEYBOARD FAULT
yes
no
OBVIOUS E.C.U. FAULT
yes
REPAIR OR REPLACE FAULTY COMPONENTS
yes
GENERAL TEST
DEFECT
no
RETURN MACHINE TO CUSTOMER

3. FAULT FINDING GUIDE

Power Supply

The power supply consists of the transformer module and most of the discrete components on the logic board. The separable transformer module consists of the transformer, main AC switch, fixed AC line card, fuse, and secondary connector and housing. The transformer produces 36 AC (approx.) to be rectified and filtered for the electronic and printer voltages, and a separate 4.7 VAC source for the filament of the display tube.

Sections on the logic board are shown below and are described along with the voltages they produce, as follows:

VSS (Zero Volts; reference, or system ground) originates at the rectifier.

VDS (-30 VDC approx.) is the rectified DC source from which the others are derived, and it also originates in the rectifier area.

VDD Is the reference voltage for the MOS/LSI and furnishes Power-On Initialize. VDD is approx. -10 VDC and is produced in the area at bottom right.

VPR Powers the printer, and must be adjusted for optimum print speed, between 15.3 and 22.9 VDC, compared to VDS.

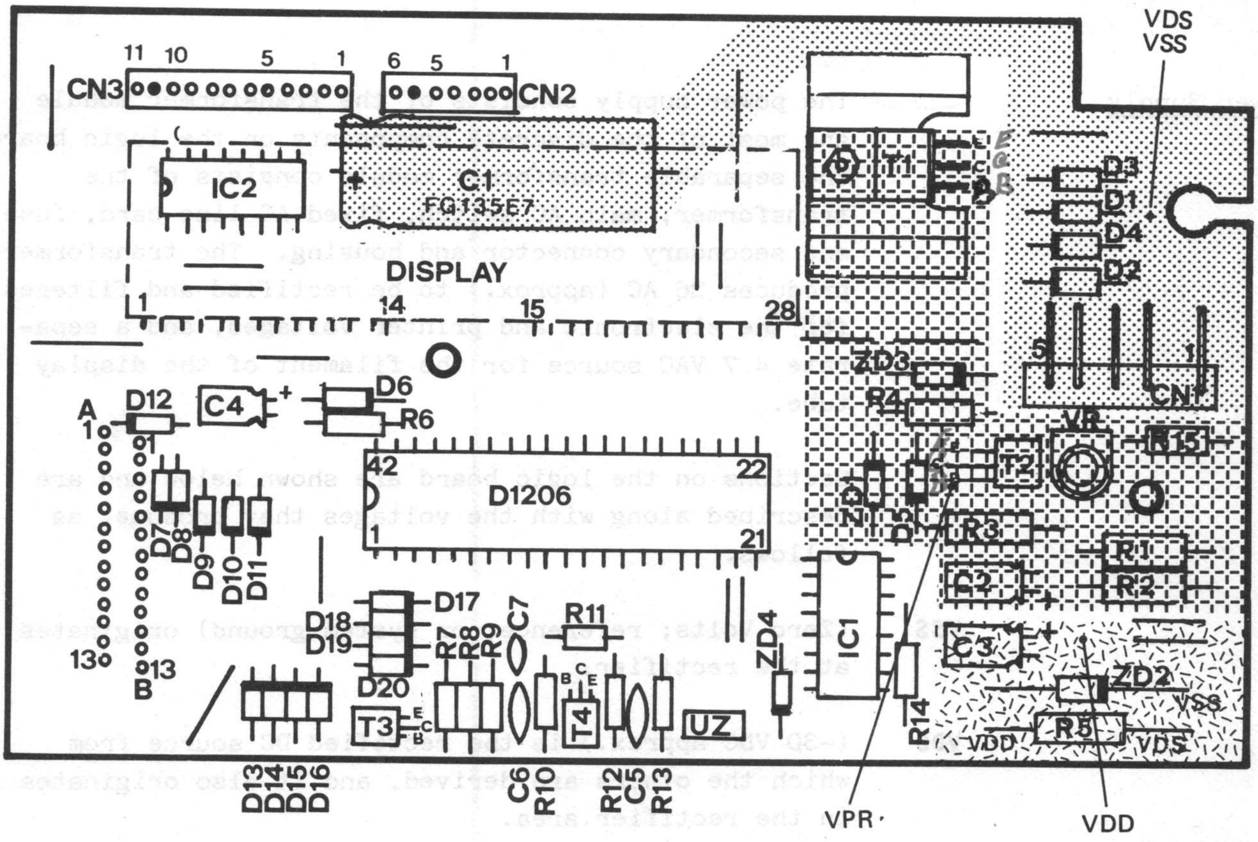
The following is a brief list of possible power supply faults and probable causes:

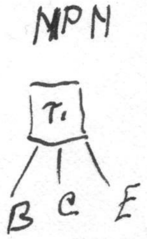
no VDS:

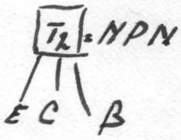
- fuse blown in transformer group
- faulty transformer windings
- faulty AC connection
- diode(s) D1, 2, 3 or 4 open

no VDD: resistor R5 open

no VPR: transistor T1 or T2 faulty.







Bij sluiting maken of display poot 40 of 41 Diode ZD2 stuk V.S.S. singaal

By aantal cyfers b.v. 4 of 5 niet in te stellen ZD2 stuk

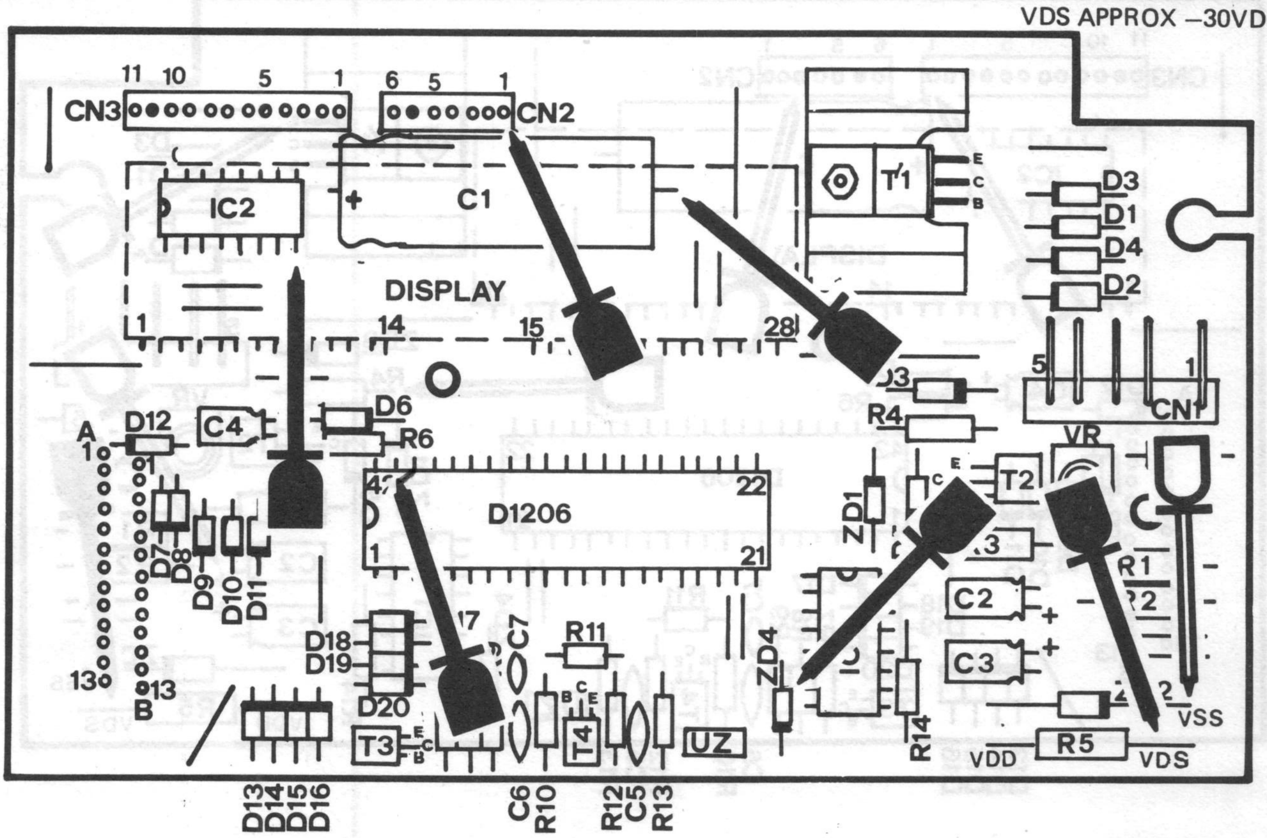
By oplichten display meer als 2 nullen ZD2 stuk of half stuk

Bij langzaam lopen print motor. of by warm worden (print motor loopt langzaam, misschien ook even snel ZD2 gedeeltelijk stuk. (niet te meten)

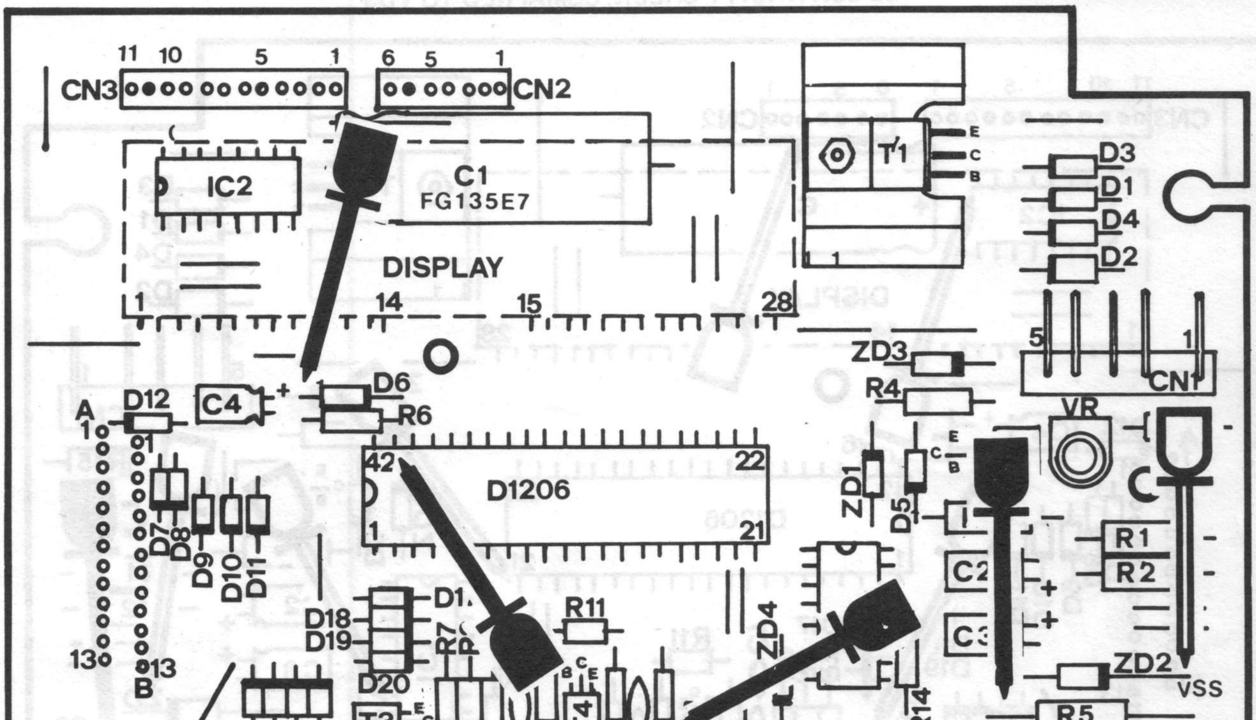
Voltage Checks,

LOGOS 48 - 49

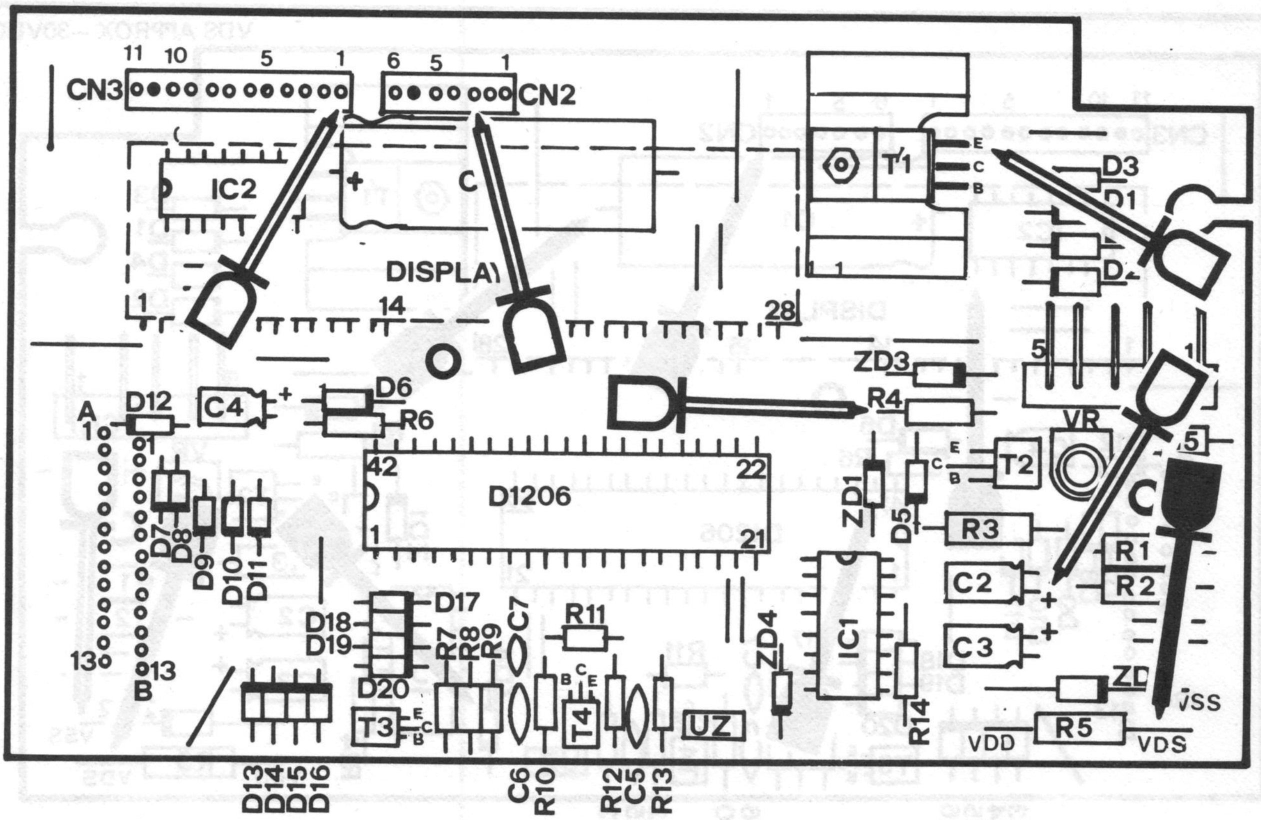
VDS APPROX –30VDC



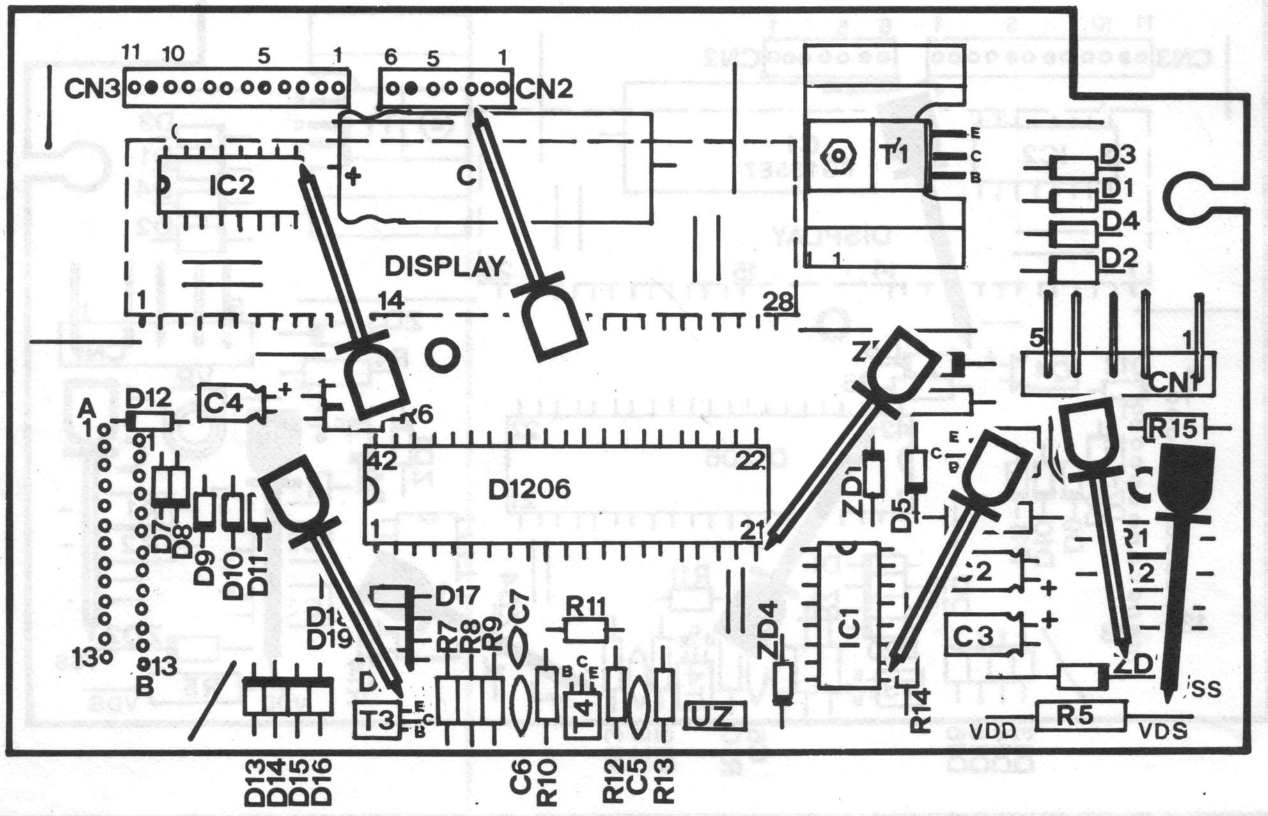
VDD APPROX –10VDC



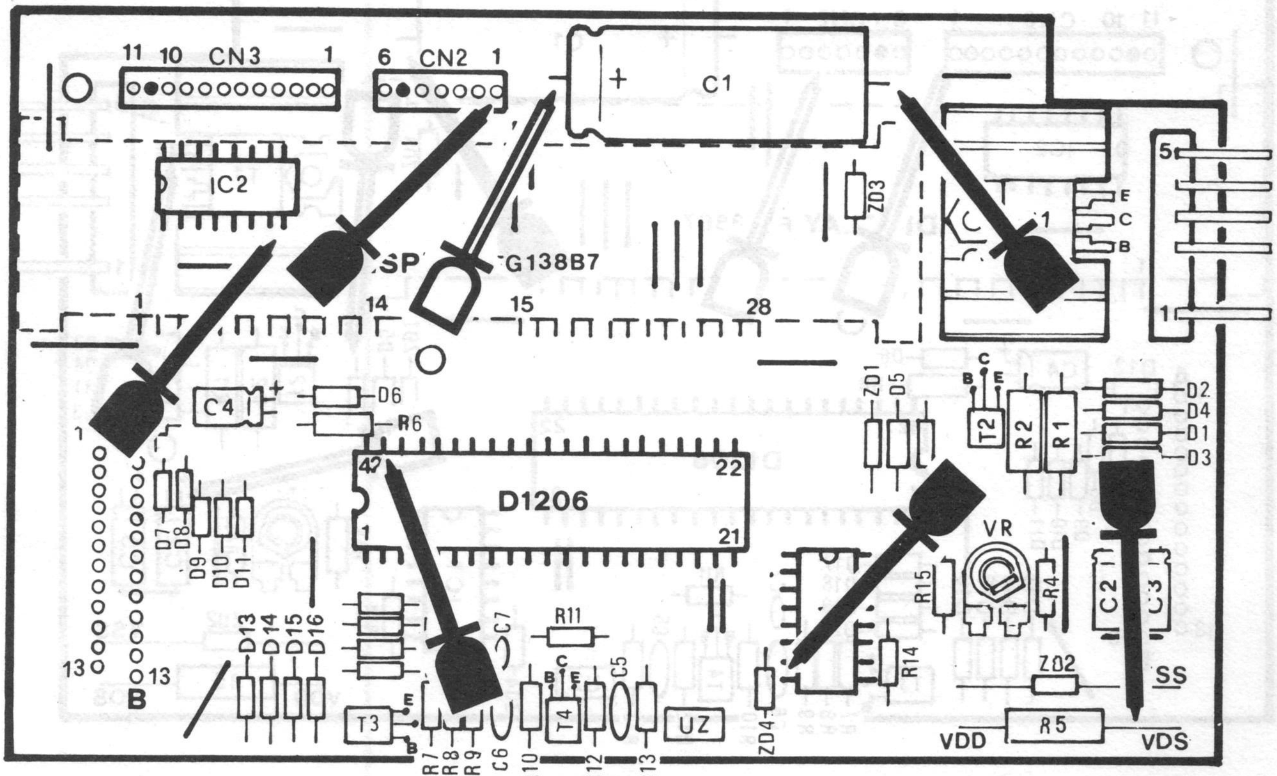
VPR DURING PRINT 15 TO 23 COMAPRED TO VDS



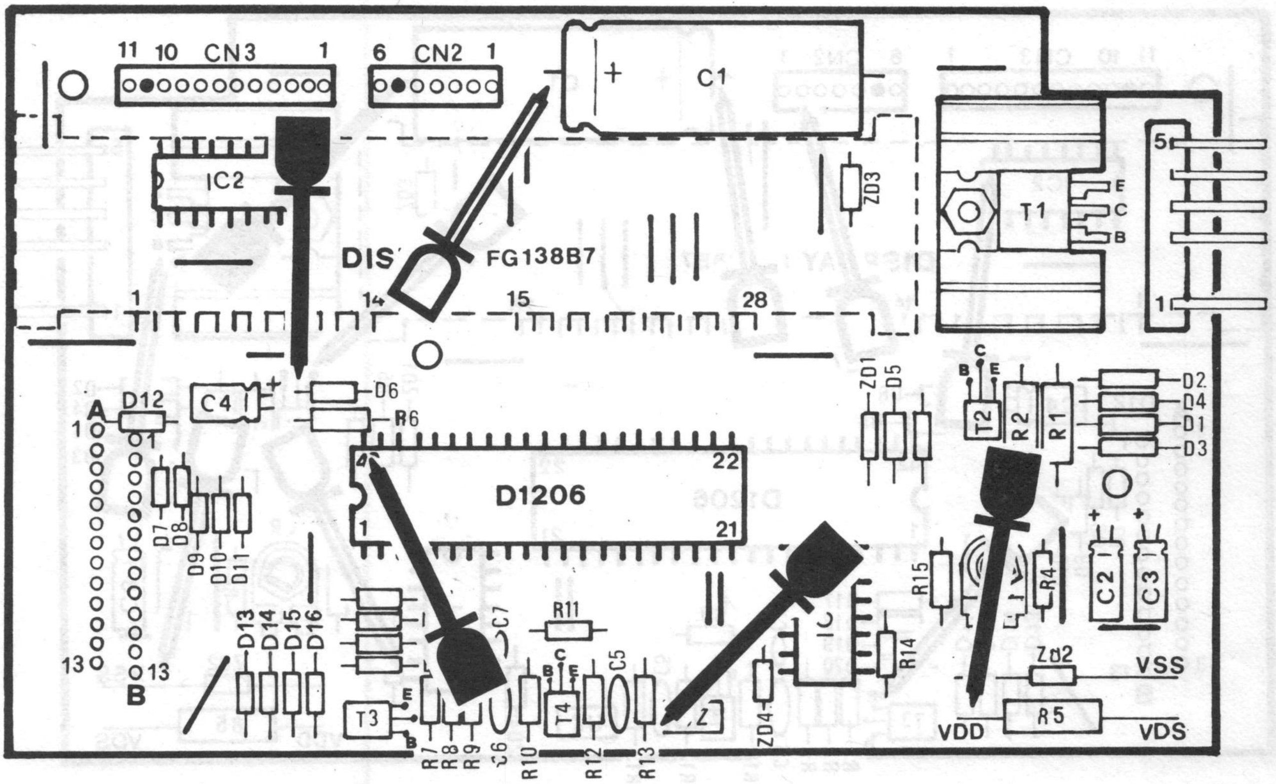
VSS CONTINUITY CHECK, COMAPRED TO VDS



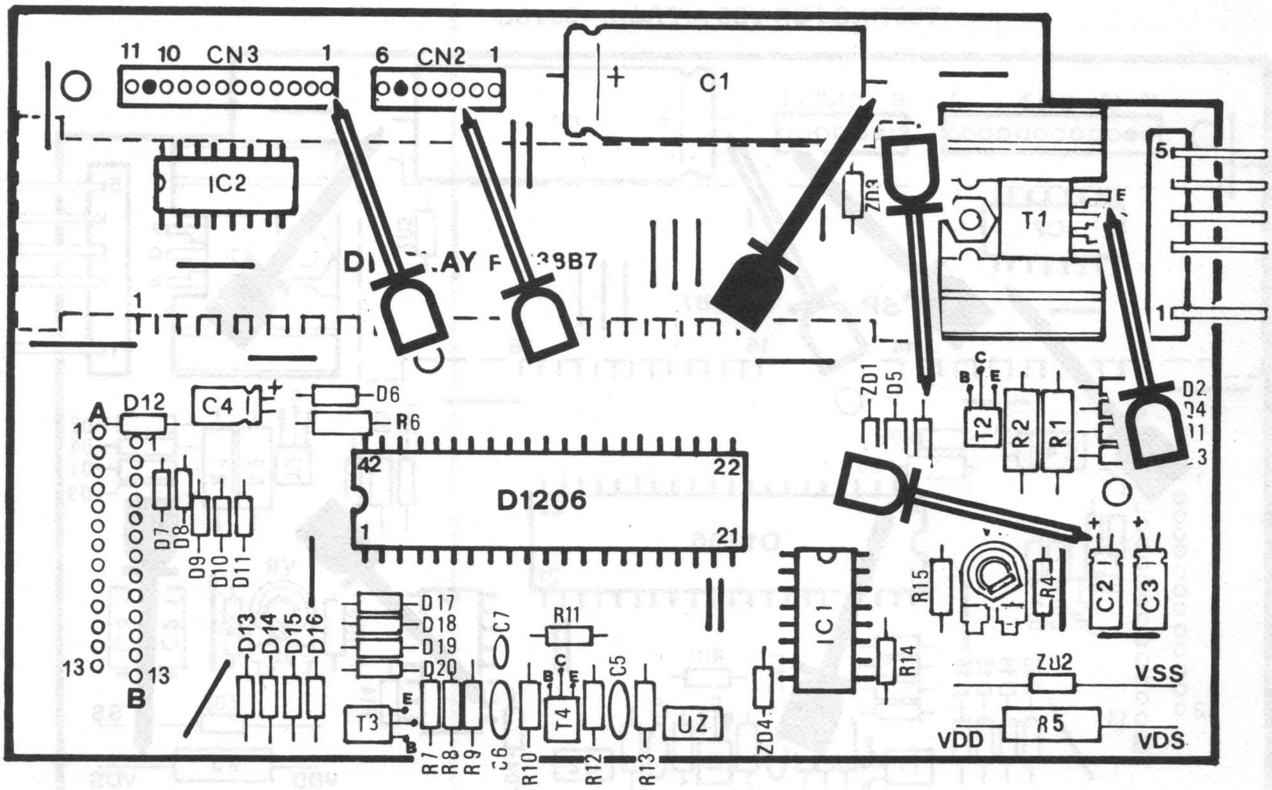
TESTING FOR VDS APPROX. –30VDC



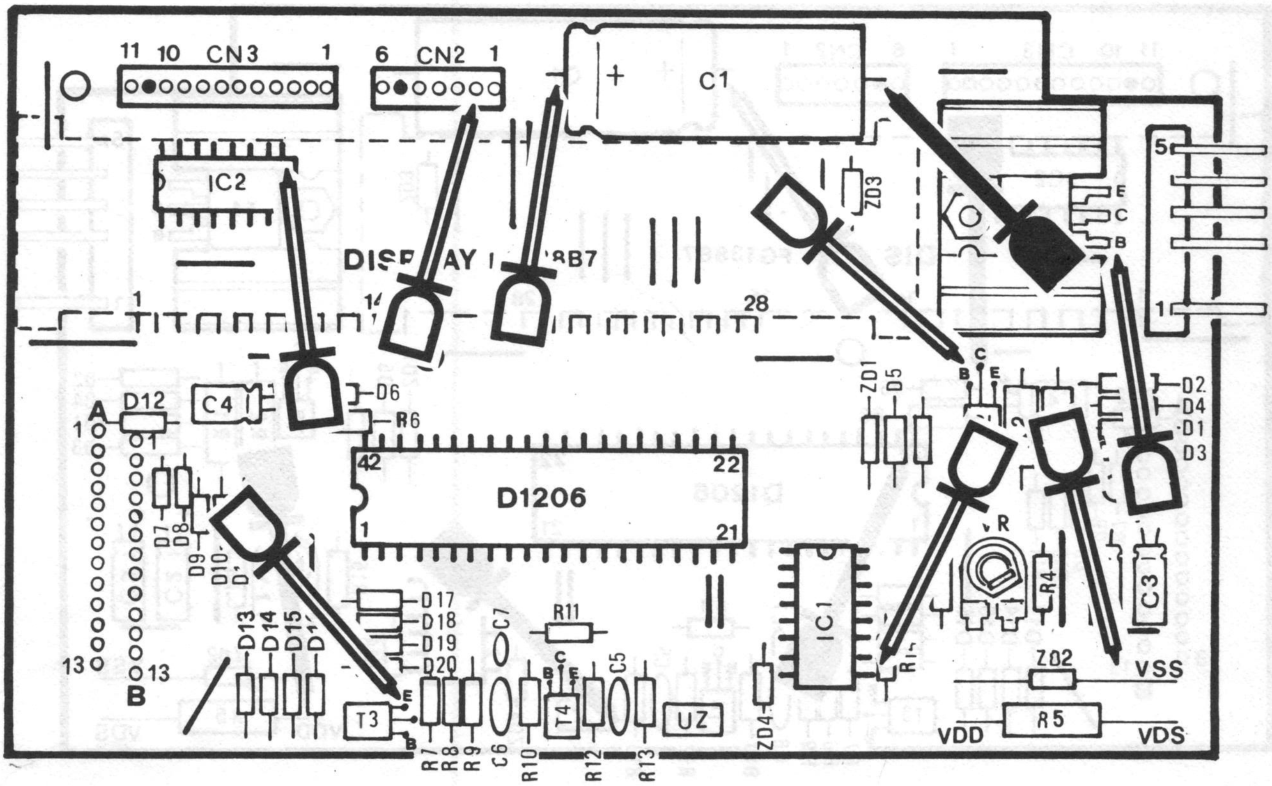
TESTING FOR VDD –10VDC



TESTING FOR VPR 15 TO 23 VDC
DURING PRINT



CONTINUITY TESTING FOR VSS (GRAUND)
COMPARED TO VDS



Printer Faults

Mechanical Printer Faults

Defect	Probable Cause
all characters print light	reset shaft adjustment incorrect; vertical alignment adjustment incorrect.
motor runs, no print	reset shaft adjustment incorrect; vertical alignment adjustment incorrect
too many dots, or dots between lines	bobbin support adjusted too far from platen; magnetic rubber faulty; reset spring broken or bent
printer jams or won't move	bobbin support adjusted too close to platen; main control cam-to-reset shaft binding; foreign material in power-train; motor-to-idle gear binding
dots missing from edges	vertical alignment adjustment incorrect
one or two characters missing from line, or light	print needle broken or binding in needle guide; coil-spring faulty or lifting anchor
character pairs print solid	reset spring broken or bent; coil-spring lifting anchor (prevents reset)
solid matrix all dots print	faulty magnetic rubber; bobbin support adjusted too far from platen
unintelligible print	grease on strobe disc or wipers

Electronic Printer Faults

Defect	Probable Cause
too many dots, or dots between lines	faulty bobbin *
printer won't move	VGG or VPR absent
one or two characters missing from line	faulty bobbin; broken wire from connector to bobbin; absent bobbin signal: PU01 through PU10
printer runs continuously, no print or faulty print	absence of E3S10 from strobe; absence of VSS to printer; absence of E3SL0 or E3S20 from strobe
printer runs normally, but no dots print	absence of VPR to bobbin assembly

Note: * To verify an individual bobbin, set the meter to Ω x 1; place one probe in VPR of connector J1 and the other probe on the bobbin signal wire to be tested. The resistance should be approximately 50-to-60 Ohms. If the reading for an individual bobbin shows discontinuity, it must be considered open, and unable to energize. Replace.

If the meter indicates a short, the possibility exists that not only is the bobbin shorted and unable to energize, but that it has also caused one of the IC drivers to short. If a shorted bobbin must be replaced, check the IC driver first, as insurance that the replacement bobbin won't be damaged by a shorted IC driver.

Magnetic Rubber Verification

Remove the adjusting eccentrics from the bobbin support and remove the rubber, the support and the bobbin assembly. Hold the bobbin assembly-and-support with the ends of the support up; the straight thin edge of the rubber should support the weight of the group when touched together. If it doesn't, replace the rubber.

Keyboard Faults

When cheking for faults in the keyboard, keep in mind that it is possible to read discontinuity because of the diodes in the keyboard circuit. These diodes prevent incorrect keyboard scanning by the MOS device by ensuring that current flows in only one direction.

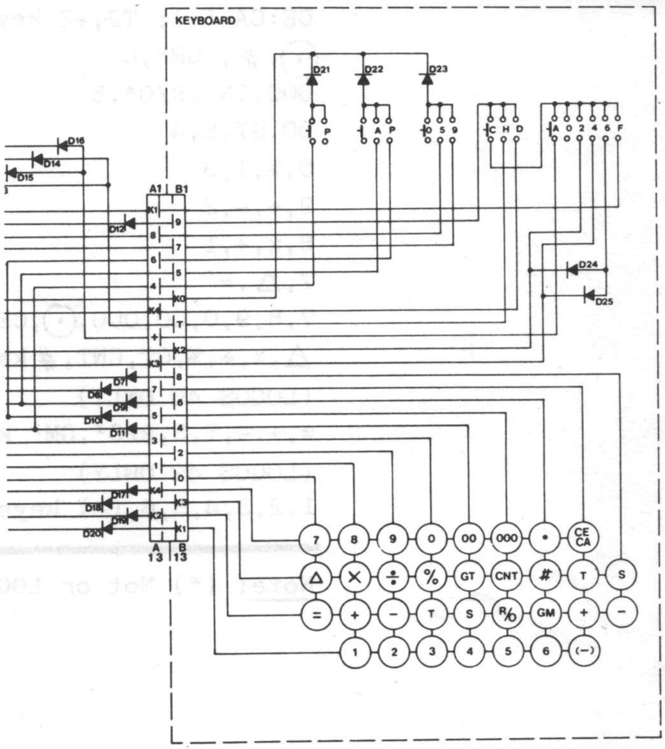
You must be sure that the meter's probes are in correct phase with respect to the anode and cathode of the diode(s). Check all diodes, including those on the logic board. The meter should show approximately 150 to 170 Ohms.

Keyswitch Verification

To verify an individual keyswitch, set the meter to Rx1 scale; place one probe on each of the two appropriate contacts on the connector edge of the keyboard module PC board. Depress the keyswitch: 0 Ohms (continuity) should register. If not, the keyswitch is faulty.

Selector Slider Verification

The technician should refer to the wiring schematic, which corresponds to the keyboard at the laminar connector. Place the meter probes on the selector to be tested, and switch the slider from position to position; this should reveal closed and open conditions: for example, testing the Print/Non-Print selector in the Print position, place the probes on tracks 4 and K0, and move the slider from Non-Print to Print and back. With the slider operating properly and the probes placed correctly, the meter should show approximately 150 to 170 Ω in the Non-Print position and Discontinuity ("open") in the Print position.



Connection Faults

Faults between logic board and keyboard via board-to-board flexible connectors (broken conductors, faulty solder joints).

In the double column below, labelled SIGNAL, the left column (A) denotes the flexible connector closer to the edges of the PC boards; (B), the interior. Check diodes D7 through D25. Observe orientation of tester probes.

FAULT (the following do no operate)	SIGNAL	
	A	B
DEC @ FL	K1	-
all decimal settings same as 0	-	9
R/0 @ 5	8	-
R/0 @ 9	-	7
no effect	6	-
ACC (on)	-	5
NON-PRINT	4	-
NON-PRINT, ACC (on), R/0 @ 5,9	-	K0
DATE (LOGOS 49 ONLY)	K4	-
TIME (LOGOS 49 ONLY)	-	T
DEC @ +	+	-
DEC @ 2	-	K2
DEC @ 4	K3	-
S2,-2 Keys (LOGOS 49 ONLY)	-	8
CE:CA (-); T2,+2 keys (LOGOS 49 ONLY)	7	-
⊙, # , GM*,6	-	6
000,CNT,R/O*,5	5	-
00,GT,S,4	-	4
0,%,T,3	3	-
9,÷,-,2	-	2
8,x,+,1	1	-
7,△,=	-	0
7,8,9,0,00,000,⊙,CE:CA keys	K4	-
△,x,÷,%,GT,CNT,# keys; T2,S2 (LOGOS 49 ONLY)	-	K3
=,+,-,T,S,R/O*,GM* keys;+2,-2 (LOGOS 49 ONLY)	K2	-
1,2,3,4,5,6,(-) keys	-	K1

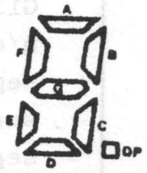
Note: (*) Not on LOGOS 46.

Keyboard Intervention

The assembly method used in production of the keyboard precludes repair of any internal fault. Therefore, be certain of any apparent keyboard fault by double-checking, since the only repair possible is replacement of the keyboard module. Carefully de-solder the flexible connectors from the keyboard and straighten the ends. Insert into the new keyboard, and solder. Remember to use the minimum heat consistent with good work man ship.

Display Faults, L46

Missing signals to display tube FG138B7.



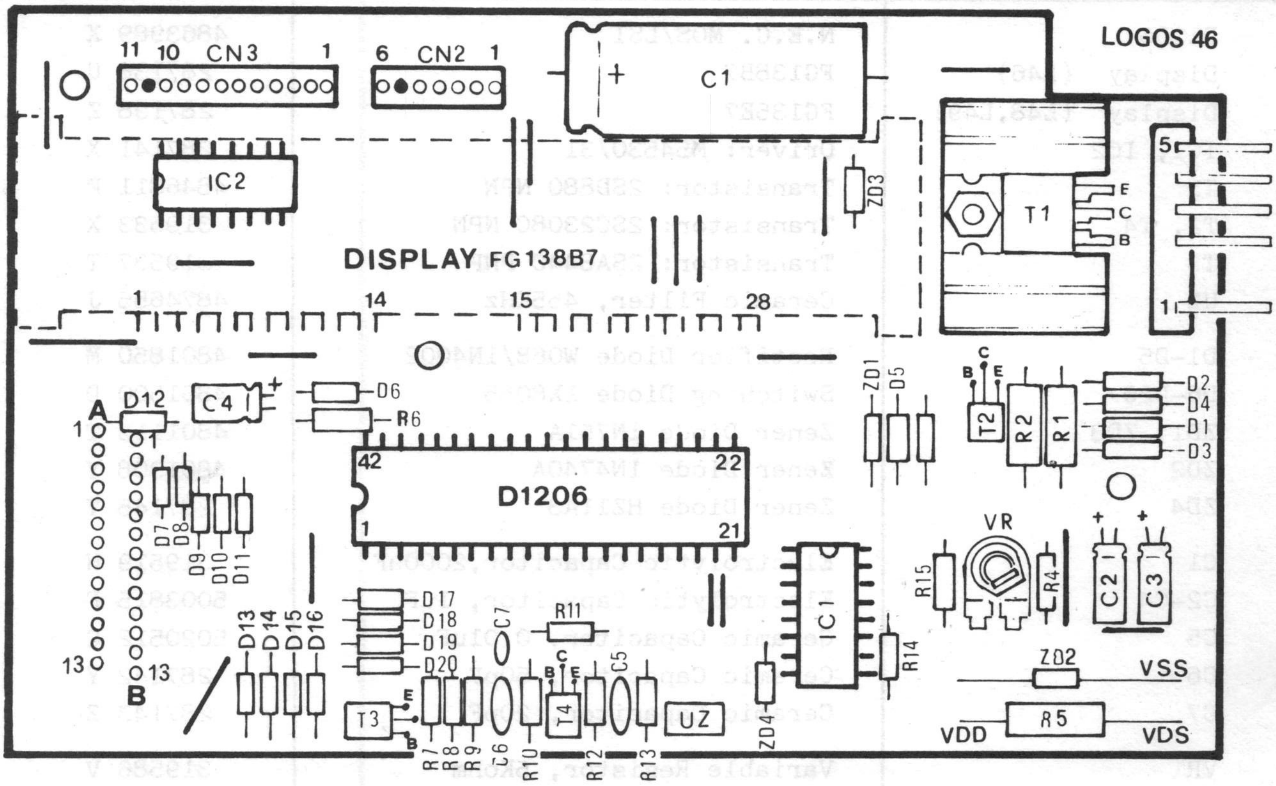
PIN	SIGNAL	FAULT
1	Fil 1	no display (extreme left)
2	seg I	the I segment does not light
3	n/e	no effect
4	seg -	the left negative sign does not light
5	seg Er	error indicator (E) does not light
6	G13	no character display in 13th position
7	seg f	all f segments do not light
8	seg g	all g segments do not light
9	seg e	all e segments do not light
10	G12	no character display in 12th position
11	G11	no character display in 11th position
12	G10	no character display in 10th position
13	G9	no character display in 9th position
14	G8	no character display in 8th position
15	G7	no character display in 7th position
16	G6	no character display in 6th position
17	G5	no character display in 5th position
18	G4	no character display in 4th position
19	G3	no character display in 3rd position
20	G2	no character display in 2nd position
21	G1	no character display in 1st position
22	n/e	no effect
23	seg d	all d segments do not light
24	seg DP	all decimal points do not light
25	seg c	all c segments do not light
26	seg b	all b segments do not light
27	seg a	all a segments to not light
28	fil 2	no display (extreme right)

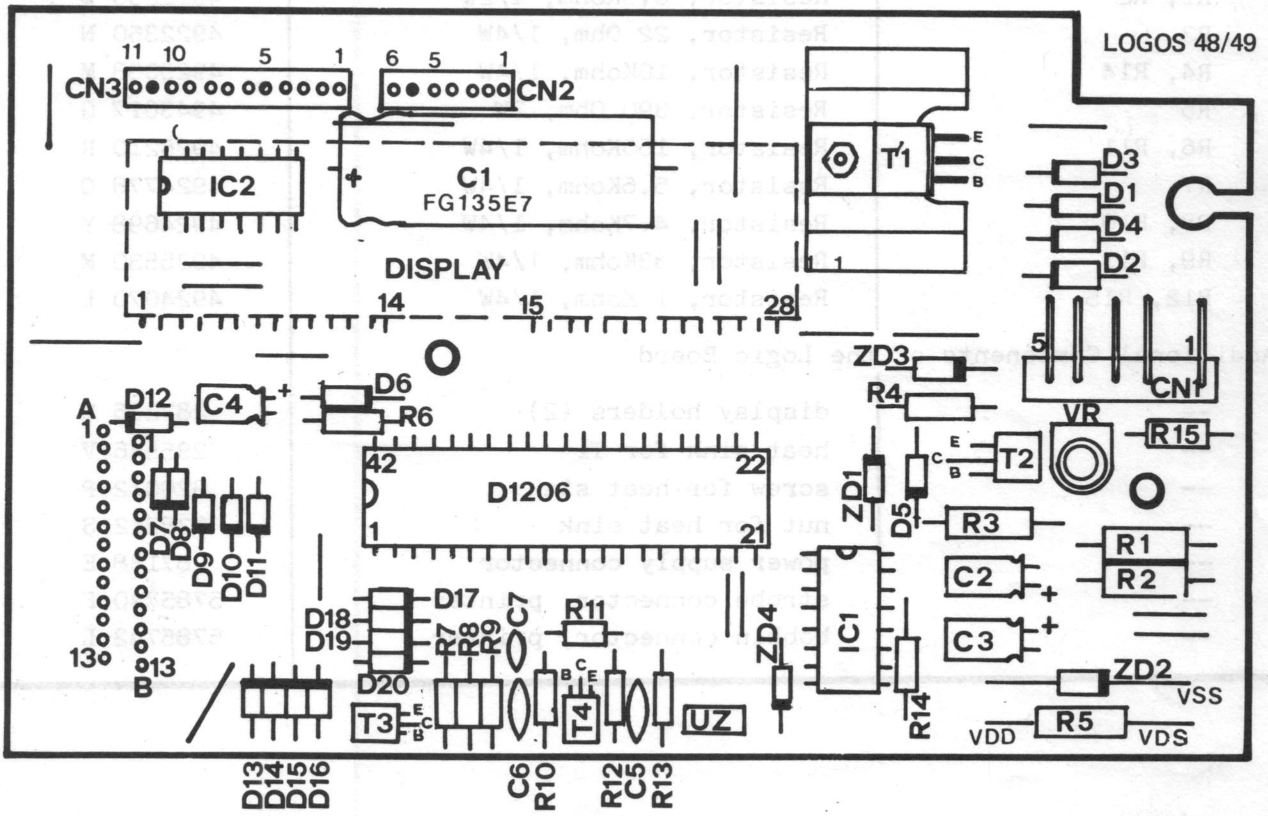
Display Faults, L48/49   Missing signals to display tube FG135E7.

PIN	SIGNAL	FAULT
1	fil 1	no display (extreme left)
2	seg M	the M segment (Memory) does not light
3	seg –	the left negative sign does not light
4	seg ←	the overflow/error arrow does not light
5	G13	no character display in 13th position
6	n/c	no effect
7	seg F	all F segments do not light
8	seg G	all G segments do not light
9	seg E	all E segments do not light
10	G12	no character display in 12th position
11	G11	no character display in 11th position
12	G10	no character display in 10th position
13	G9	no character display in 9th position
14	G8	no character display in 8th position
15	G7	no character display in 7th position
16	G6	no character display in 6th position
17	G5	no character display in 5th position
18	G4	no character display in 4th position
19	G3	no character display in 3rd position
20	G2	no character display in 2nd position
21	G1	no character display in 1st position
22	n/c	no effect
23	seg P	all decimal points do not light
24	seg D	all D segments do not light
25	seg C	all C segments do not light
26	seg B	all B segments do not light
27	seg A	all A segments do not light
28	fil 2	no display (extreme right)

A. TECHNICAL APPENDIX

Logic Board Layouts

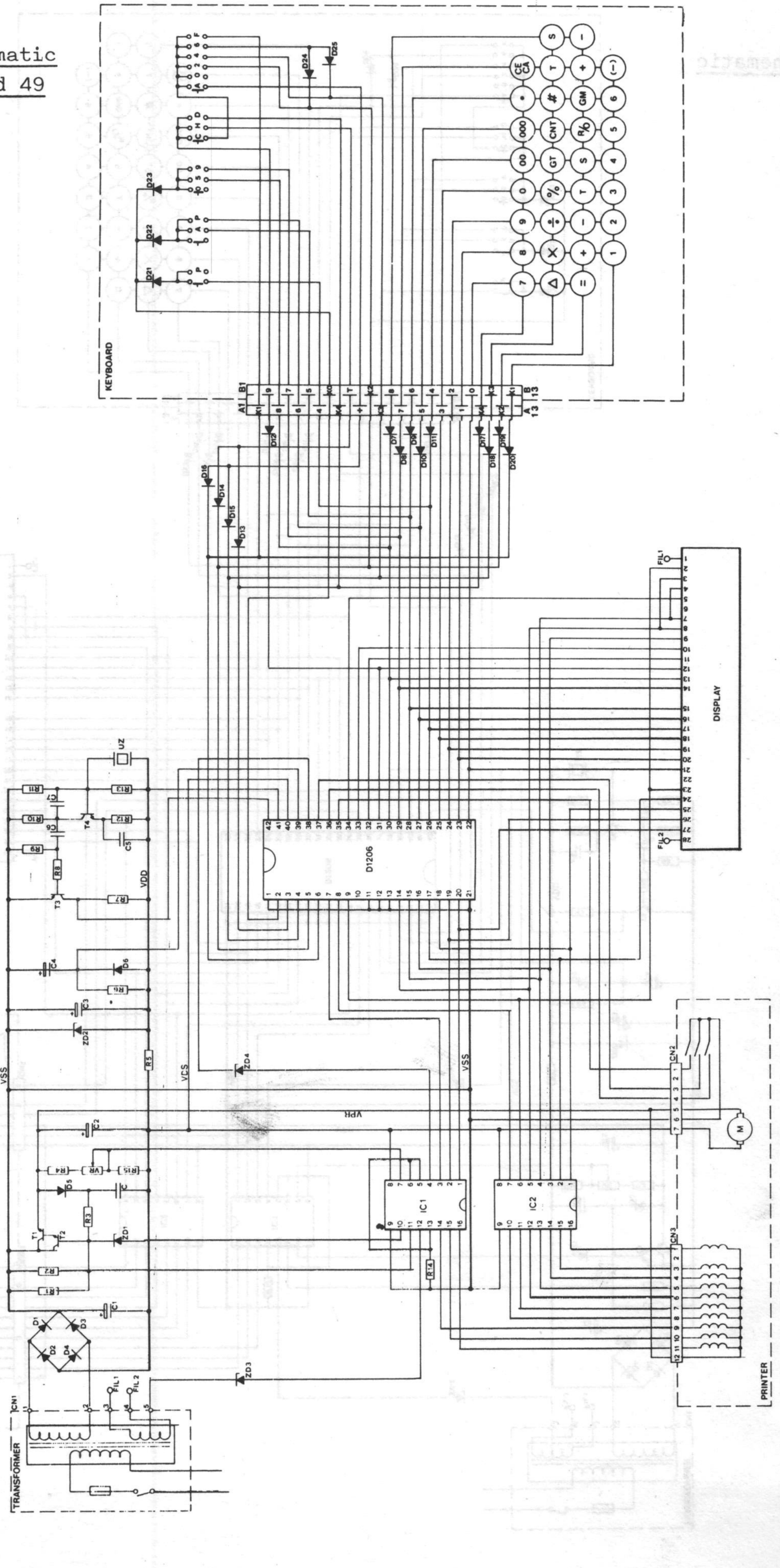




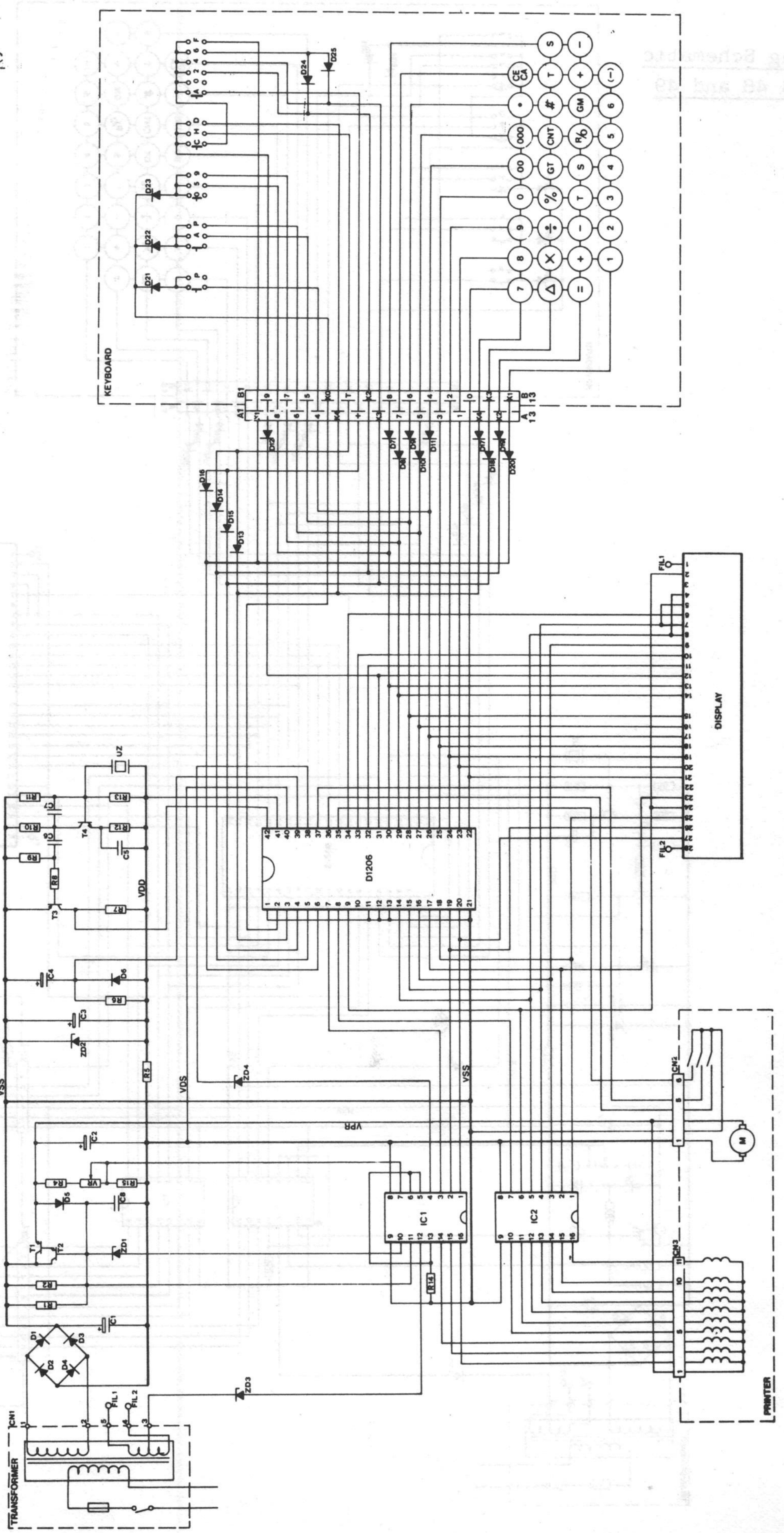
Electronic Components List

Identification	Description	Part Number
D1206	N.E.C. MOS/LSI	4863989 X
Display (L46)	FG138B7	287138 U
Display (L48,L49)	FG135E7	287198 Z
IC1, IC2	Driver: M54530/31	287141 X
T1	Transistor: 2SD880 NPN	4846811 P
T2, T4	Transistor: 2SC2308C NPN	319533 X
T3	Transistor: 2SA844C PNP	319537 T
UZ	Ceramic Filter, 455KHz	4874655 J
D1-D5	Rectifier Diode W06B/1N4002	4801850 M
D6-D20	Switching Diode 1X8055	4801500 D
ZD1, ZD3	Zener Diode 1N751A	4801113 T
ZD2	Zener Diode 1N4740A	4801308 Y
ZD4	Zener Diode HZ11A3	287145 T
C1	Electrolytic Capacitor,2000uF	319519 H
C2-C4	Electrolytic Capacitor, 1uF	5003815 F
C5	Ceramic Capacitor, 0.01uF	5020512 G
C6	Ceramic Capacitor, 50pF	287142 Y
C7	Ceramic Capacitor, 20pF	287143 Z
VR	Variable Resistor, 5Kohm	319586 V
R1, R2	Resistor, 3.3Kohm, 1/2W	4911253 Q
R3	Resistor, 22 Ohm, 1/4W	4922350 N
R4, R14	Resistor, 10Kohm, 1/4W	4925058 M
R5	Resistor, 390 Ohm, 2W	4943617 G
R6, R11	Resistor, 150Kohm, 1/4W	4926210 R
R7	Resistor, 5.6Kohm, 1/4W	4924778 Q
R8, R10	Resistor, 4.7Kohm, 1/4W	4924698 Y
R9, R13	Resistor, 33Kohm, 1/4W	4925530 M
R12, R15	Resistor, 1 Kohm, 1/4W	4924070 L
Additional Components of the Logic Board		
--	display holders (2)·	287236 W
--	heat sink for T1	295546 V
--	screw for heat sink	920012 P
--	nut for heat sink	938212 S
--	power supply connector	287148 E
--	strobe connector, printer	5785740 F
--	bobbin connector, printer	5785742 L

Wiring Schematic
LOGOS 48 and 49



Wiring Schematic
LOGOS 46



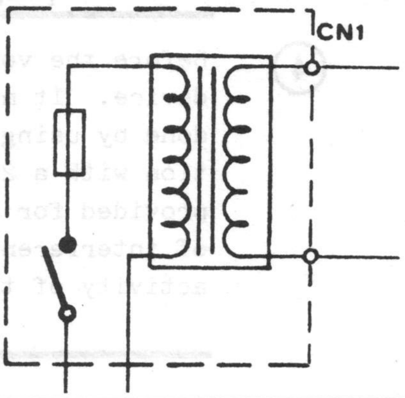
Circuit Analysis

In this section the transformer, power supply and motor circuits will be explained in detail. Read the paragraphs, in order, and study each of the illustrations as the circuits are constructed. You should have a good working knowledge of all discrete circuitry upon completion of this section.

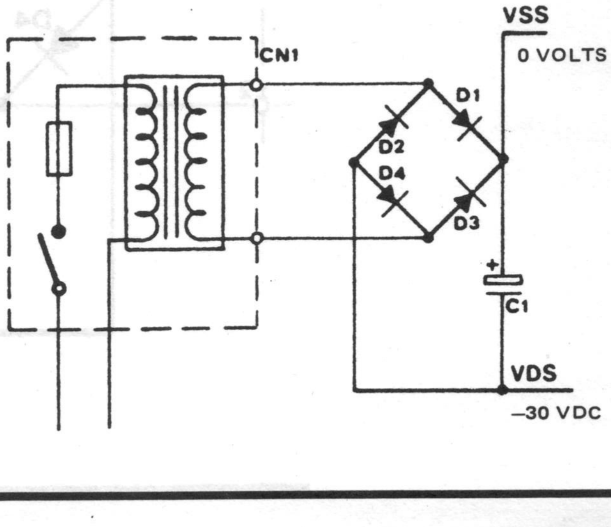
Note: All stated voltages are nominal and may vary.

VSS = 0 VDC; system ground
VDD = -10 VDC; logic low level
VDS = -28 to -33 VDC

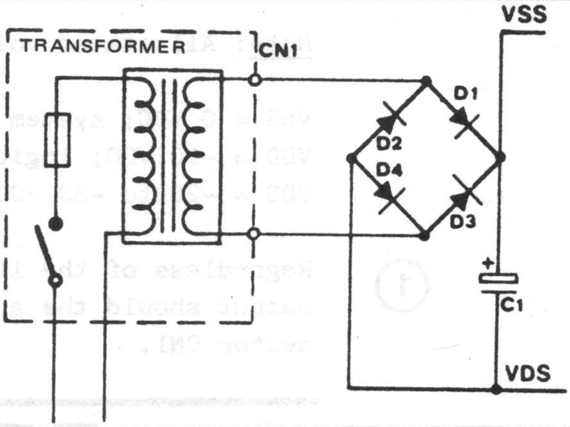
① Regardless of the line input of the transformer, the output should the approximately 36 Volts AC at connector CN1.



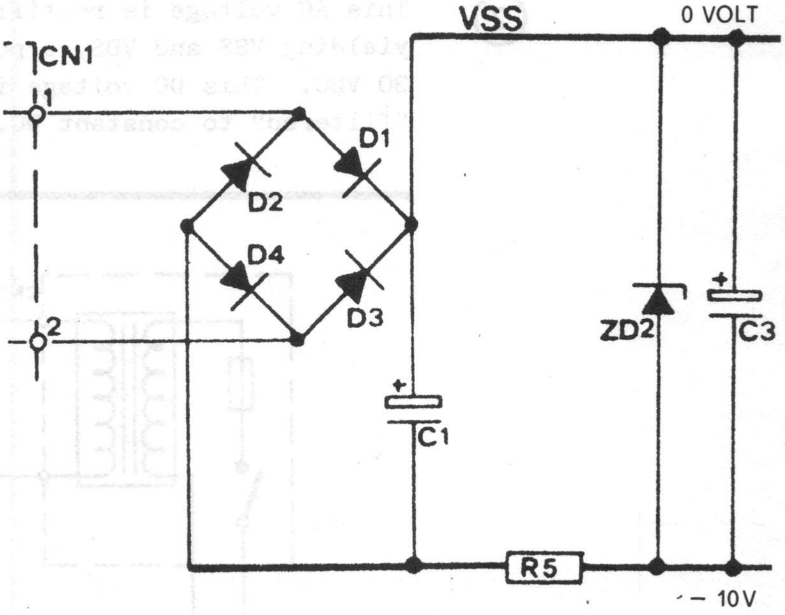
② This AC voltage is rectified by diodes D1 through D4, yielding VSS and VDS, a potential of approximately 30 VDC. This DC voltage is pulsating, and must be "filtered" to constant DC.



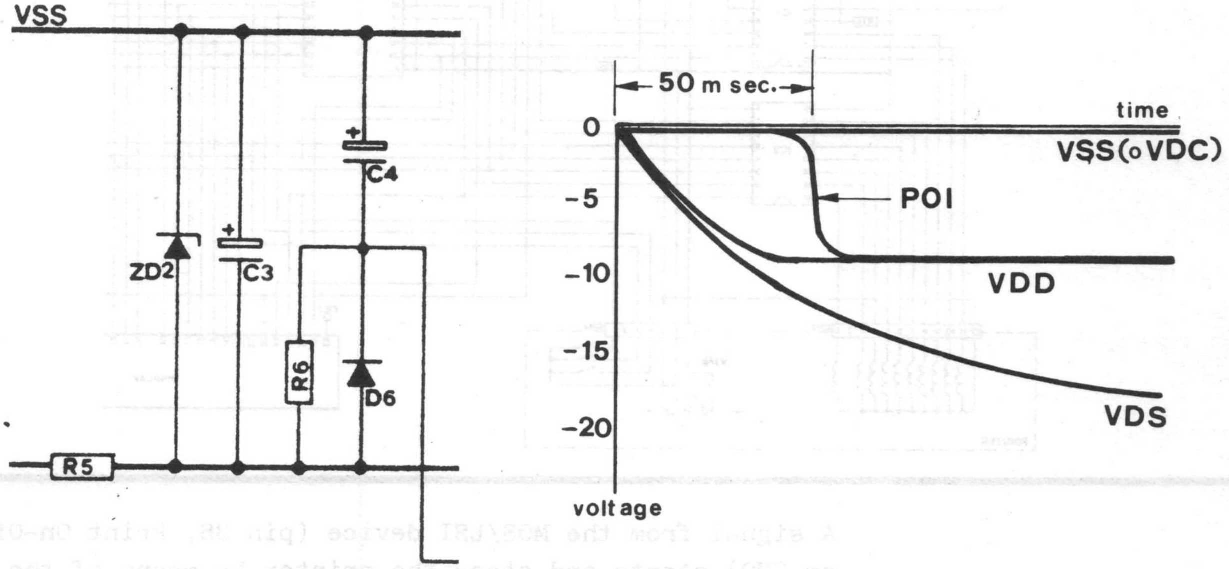
③ To filter or "level" the pulsating DC voltage, an electrolytic capacitor C1 is placed in the circuit which will accept the peaks in the DC voltage but discharge at a constant rate, thus filtering the 30 Volt potential between VSS and VDS.



④ Before the voltage can be applied to the MOS/LSI device. It must be reduced to VDD: -10 VDC. This is done by using a 10 Volt Zener diode (ZD2) in conjunction with a 2 Watt resistor, R5. Capacitor C3 is provided for decoupling, to eliminate the possibility of interference from high-frequency "noise" due to the activity of the MOS/LSI device.



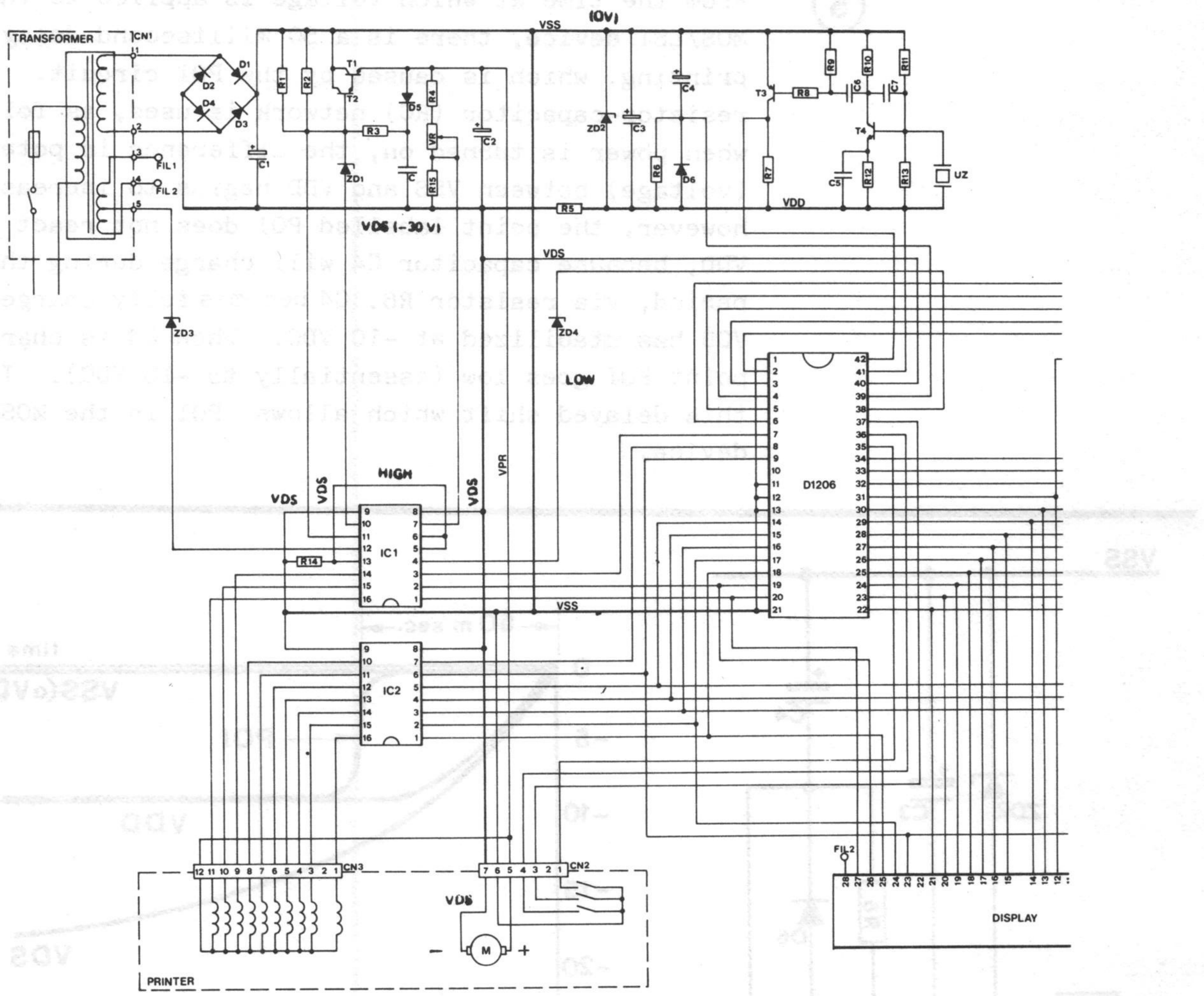
⑤ From the time at which voltage is applied to the MOS/LSI device, there is a 50 millisecond delay before printing, which is caused by the POI circuit. A resistor-capacitor (RC) network is used, as follows: when power is turned on, the difference in potential (voltage) between VSS and VDD begins to increase; however, the point labelled POI does not react like VDD, because capacitor C4 will charge during this period, via resistor R6. C4 becomes fully charged when VDD has stabilized at -10 VDC. When C4 is charged, point POI goes low (essentially to -10 VDC). It is this delayed shift which allows POI in the MOS/LSI device.



Diode D6 ensures that the charge of capacitor C4 is drained when power is lost or turned off. Therefore, POI can recur when power returns.

⑥ Note: The IC drivers (IC1 and IC2) are shown inverted from usual orientation, in this section and on the schematic.

As indicated in the motor circuit diagram, VSS is used to obtain VPR for the printer. Regulation and additional functions will be explained in the following pages. It is important to note that VPR is the positive printer signal, and that VDS (-30 VDC approx.) is the negative. Therefore, VPR is measured as a positive voltage from VDS as its reference. If measured conventionally, using VSS as reference, VPR could be measured as from -6 VDC to -15 VDC.



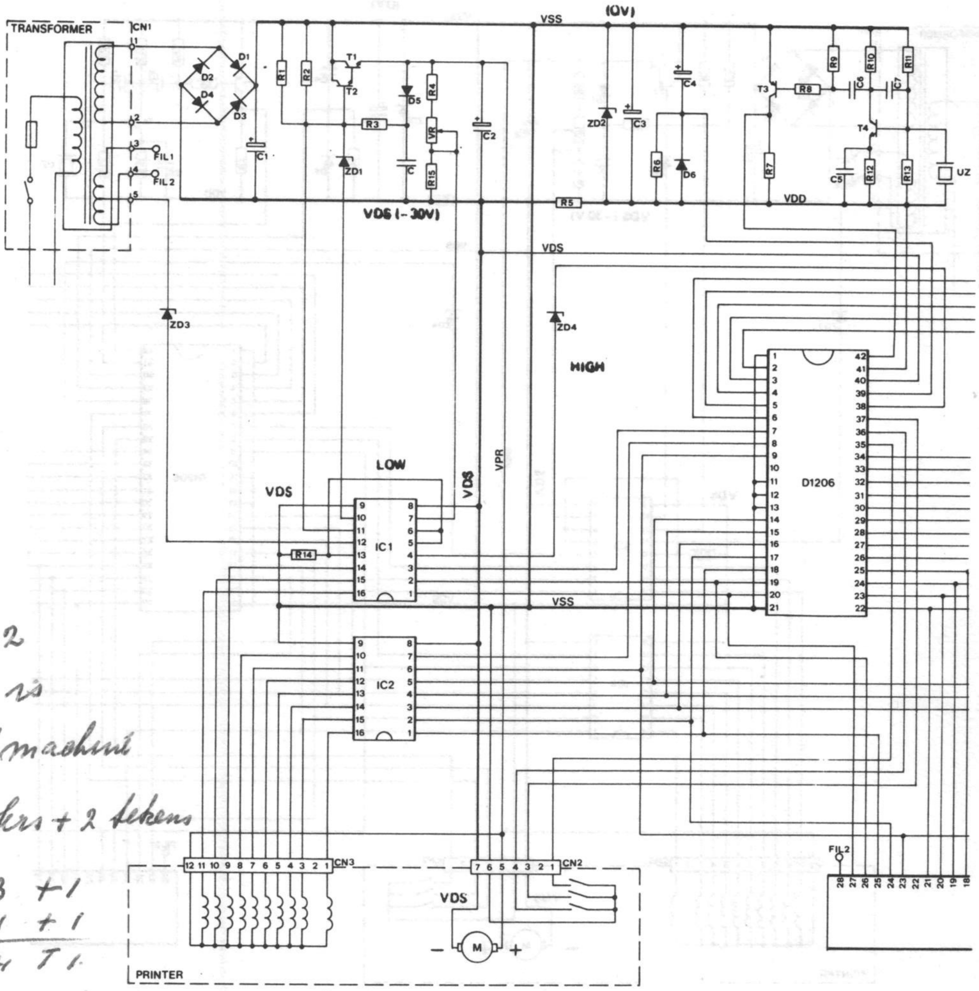
A signal from the MOS/LSI device (pin 38, Print On-Off or CMO) starts and stops the printer by means of the motor circuit shown above. The IC driver can control a greater current than can the MOS/LSI device.

With the calculator on and the printer at rest, signal CMO is low at pin 4 of IC1. Its output pin 13 is held high by resistor R14. This high level is present at input pin 6; its output pin 11 is internally switched to VDS. All current through resistors R1 and R2 is pulled to VDS, by IC1. This prevents any voltage at the base of transistor T2; transistor T2 is off, therefore T1 is off. R1 and R2 are large enough to dissipate the current without difficulty.

langzaam lopen motor of bij warm worden EG.

ZD2 gedeeltelijk stuk
(niet te meten / diode lijkt goed,
maar is fout

⑦

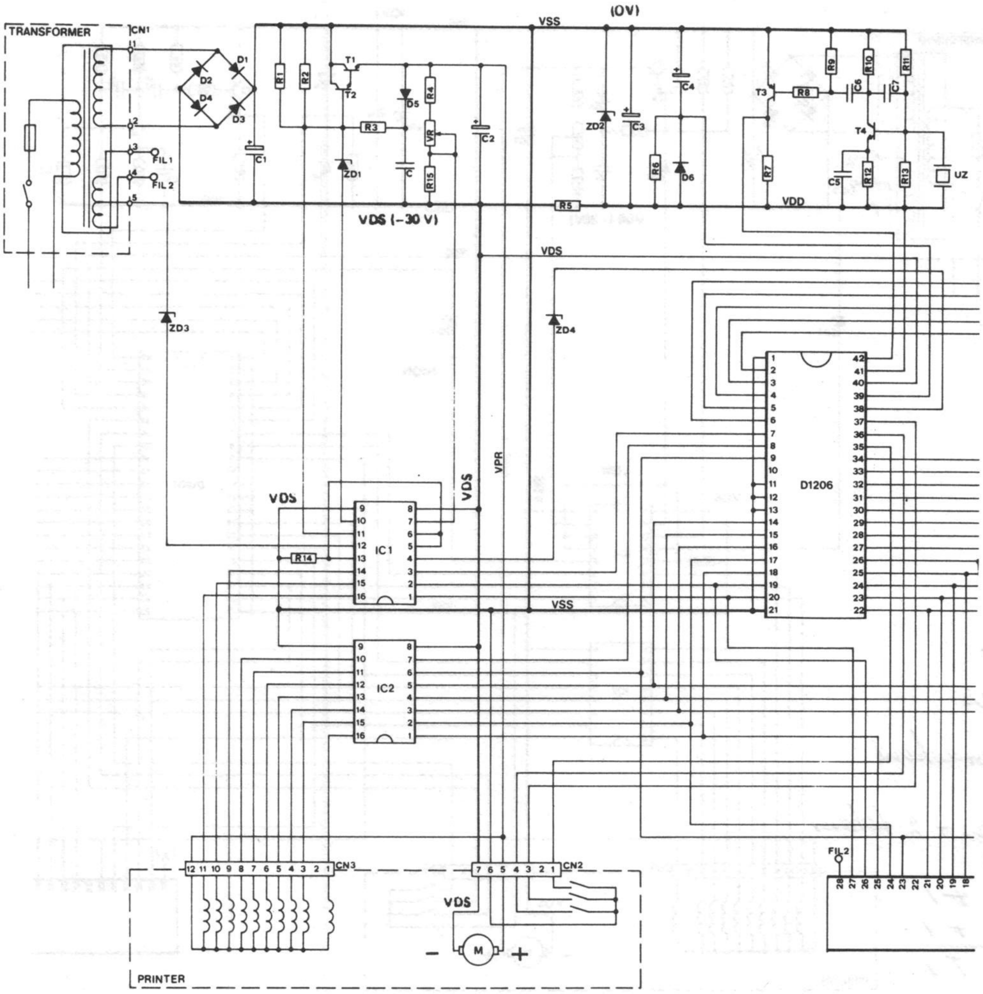


Als I.C 2
er uit is
schrijft machine
nog 3 cyfers + 2 tekens
b.v. 123 +1
b.v 321 +1
T= 444 T1.
rest van cyfers wordt geprint door IC 2

When the calculator is required to print, pin 38 (signal CMO) of the MOS/LSI device switches high (to VSS). When this happens, the high level at pin 4 of IC1 will switch the output pin 13 low and, via input pin 6, cause a high level at pin 11. This high level is present at the base of T2, allowing T2 to turn on T1, producing VPR to run the printer motor.

Additional components of the printer circuit provide features such as braking, limiting, adjustability, etc. Those are explained next.

⑧



The network consisting of resistors R4, R15 and VR, and the segment of OC1 consisting of pins 7 and 10 provide motor speed adjustment. This is not accomplished by affecting the output of VPR, but rather by sensing the output, and compensating, accordingly.

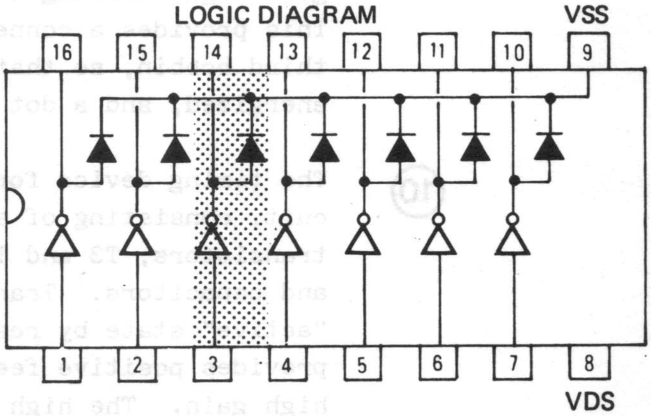
The adjustable "output" of VR is applied to the input pin 7 of IC1, to control transistor T2, via output pin 10 and ZD1. Adjusting VR causes T2 to affect T1 differently, as required for correct VPR level. With the correct adjustment performed, this network will compensate for load variations while the printer is running.

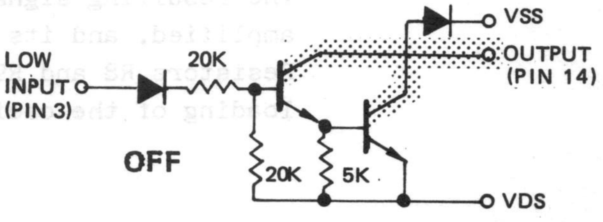
Braking is required simultaneously, when CMO switches low, because the printer must not cast past the correct starting point. Therefore, a means is provided to stop the motor very quickly at the end of the print cycle. This means is diode D5.

Note in paragraph 6 that when signal CMO is low (Print-Stop), the base of transistor T2 is at VDS: -30 VDC. Diode D5 conducts (to pin 11 of IC1) any residual or regenarative motor current to VDS, which places both motor leads at the same level. This stops the motor very quickly.

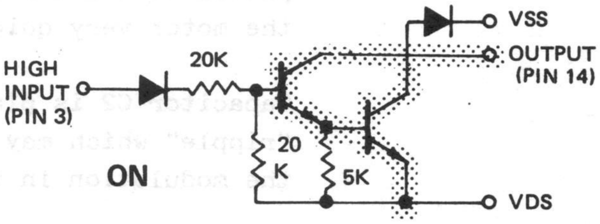
Capacitor C2 is placed in the circuit to absorb any "ripple" which may be present in VPR as a result of the modulation in the adjustment network.

⑨ This discussion is on the operation of the drivers, IC1 and IC2, which are switching devices to control high power output with low power input. Therefore, they are used in the printer circuit, and protect the MOS/LSI from the high power required for printing. Consider one segment of one of the drivers - pin 3/pin 14.





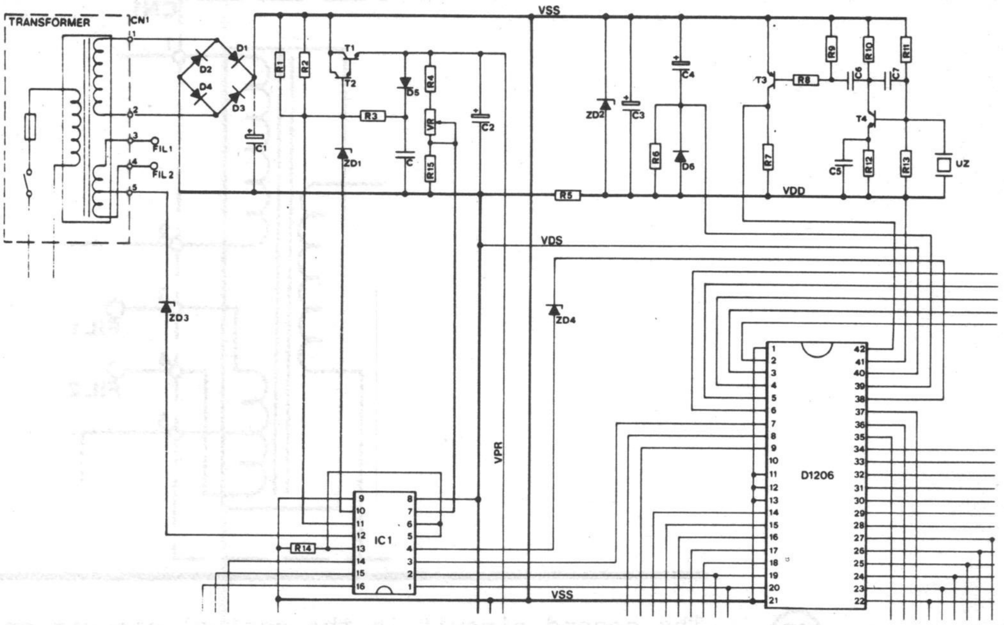
If the input signal from a source, on pin 3, is low, the Darlington array cannot turn on, and pin 14 is at its respective supply voltage. The driver segment has not connected pin 14 to reference (VDS).



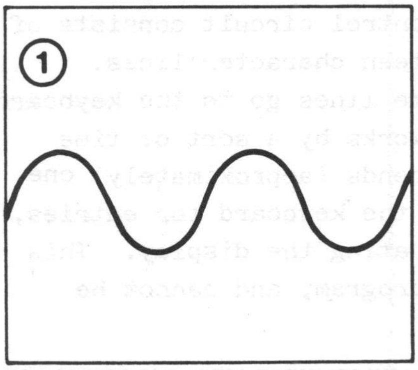
If the input signal on pin 3 goes high, the Darlington array would turn on, and pin 14 is connected to reference (VDS). The respective supply voltage is pulled to VDS, and can perform some operation. For example, during a print cycle, VPR is applied to all bobbins. To print a dot with the third bobbin, MOS/LSI pin 16 goes high, turning on driver segment pin 3/pin 14. This provides a connection to reference (VDS) for the third bobbin, so that current can flow: the bobbin is energized, and a dot is printed.

⑩ The timing device for the calculator is a clock circuit, consisting of a ceramic resonator (UZ) and two transistors, T3 and T4, and their required resistors and capacitors. Transistor T4 is based into an "active" state by resistors R11 and R13. Capacitor C7 provides positive feed back, and capacitor C5 ensures high gain. The high gain, feed back, and the presence of the ceramic resonator ensure that this circuit will oscillate, and at a very precise frequency of 455K Hz. Also, as a result of the switching of the transistor, the waveform is improved.

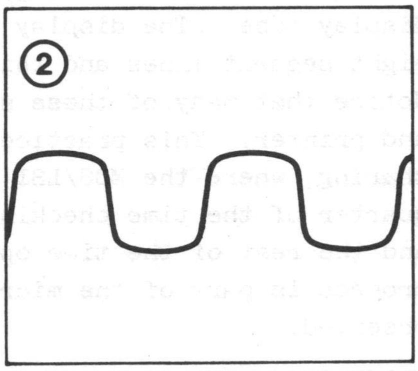
The resulting signal at the collector of T4 is further amplified, and its waveform improved further by T3. Resistors R8 and R9 provide input bias with minimum loading of the oscillator circuit.



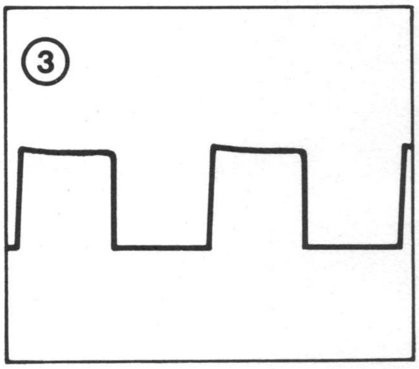
①



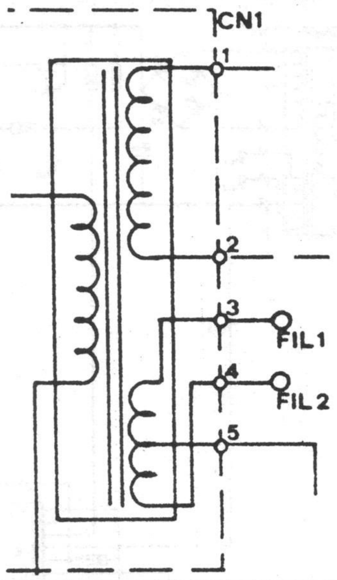
②



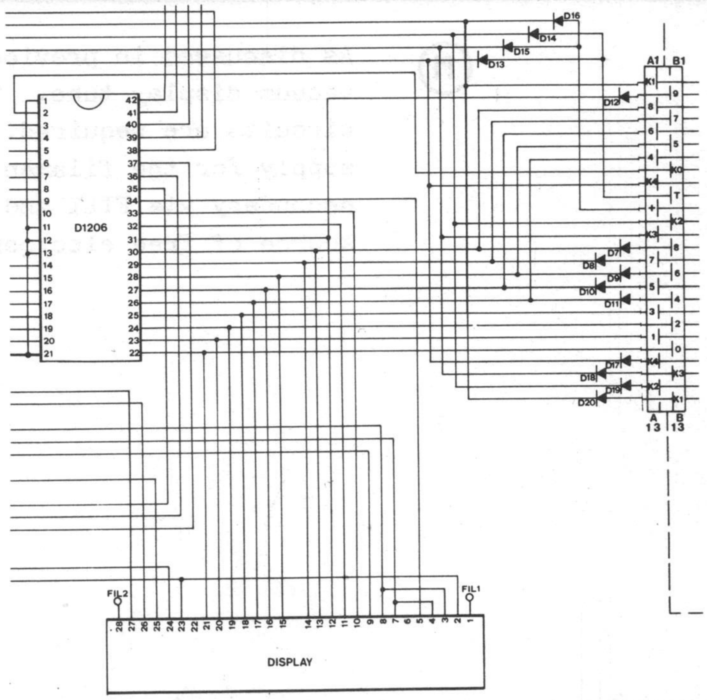
③



⑪ As discussed in previous pages, the calculator has a vacuum display tube. To operate this display, special circuits are required. The first is simply a 4.7 VAC supply for the filament, direct from the transformer secondary via FIL1 and FIL2. The filament becomes a source of free electrons for the process.

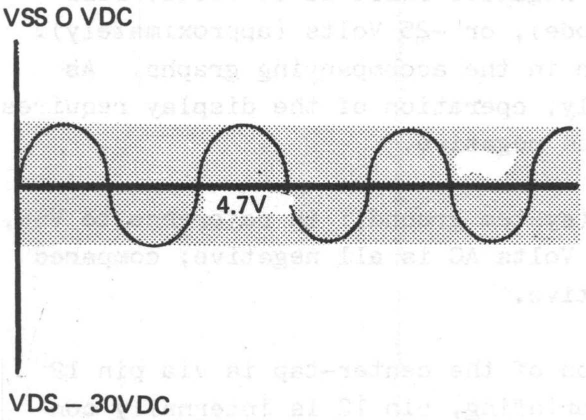


⑫ The second circuit is the control circuit provided by the MOS/LSI device, which determines which segments and characters will be lighted during scanning of the display tube. The display control circuit consists of eight segment lines and thirteen character lines. Notice that many of these same lines go to the keyboard and printer. This practice works by a sort of time sharing, where the MOS/LSI spends (approximately) one quarter of the time checking the keyboard for entries, and the rest of the time operating the display. This process is part of the microprogram, and cannot be observed.

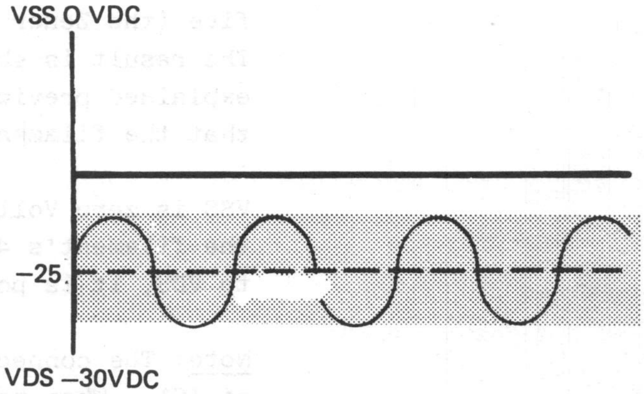


A negative voltage is required to operate the display, and this voltage is VDS:-30 VDC. Its application in the display circuit will be explained next.

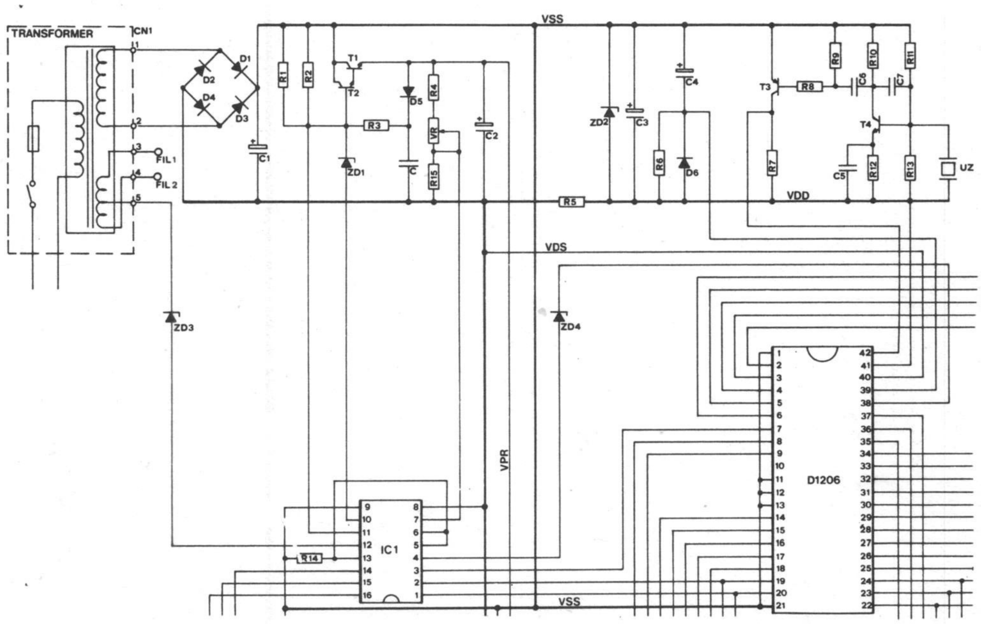
⑬



UNREFERENCED AC FILAMENT VOLTAGE



AC FILAMENT VOLTAGE REFERENCED TO VDS VIA DIODE ZD3



To this point we have introduced an AC voltage to the filament: FIL1 and FIL2. By introducing a center-tap between FIL1 and FIL2, and then connecting this center-tap to a negative voltage, the AC voltage is shifted negative and, at the same time, referenced to the controlled voltages of the machine.

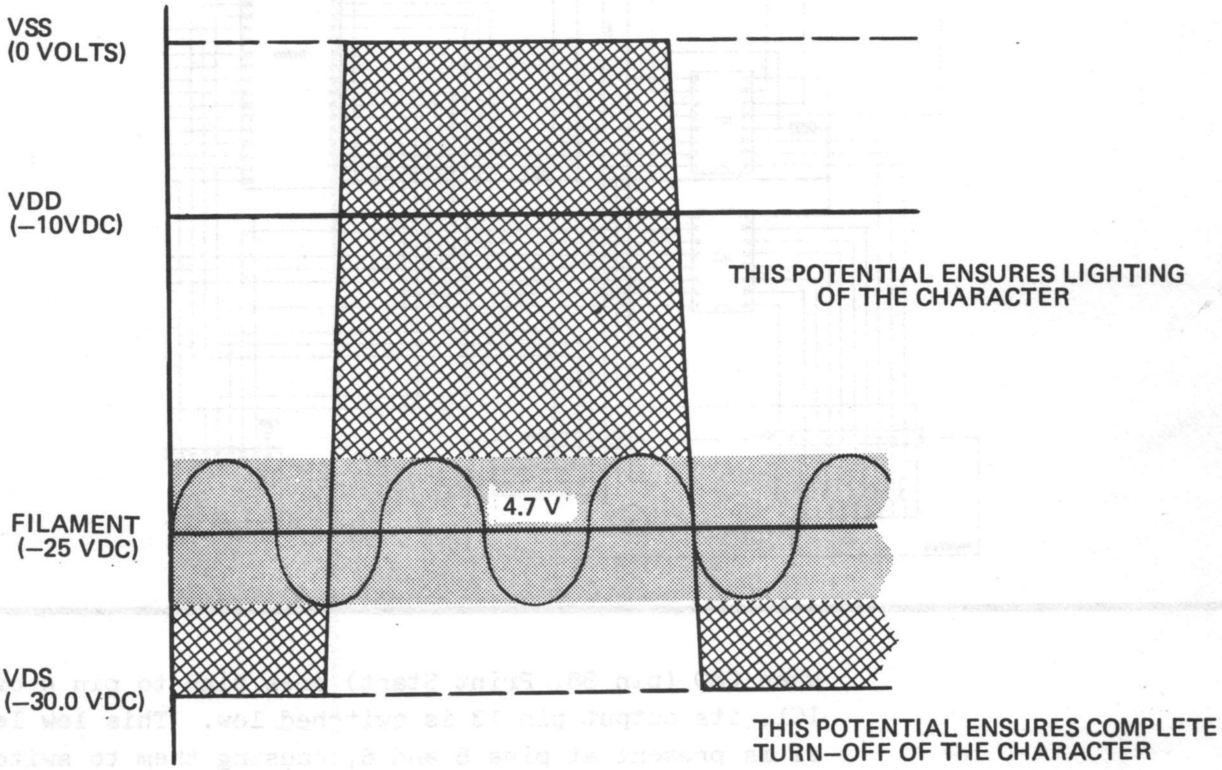
The connection to VD5 is through a five Volt Zener diode, ZD3, so the negative shift is 30 Volts, less five (the Zener diode), or -25 Volts (approximately). The result is shown in the accompanying graphs. As explained previously, operation of the display requires that the filament be negative.

VSS is zero Volts (system ground): in reference to VSS, the filament's 4.2 Volts AC is all negative; compared to VDS, it is positive.

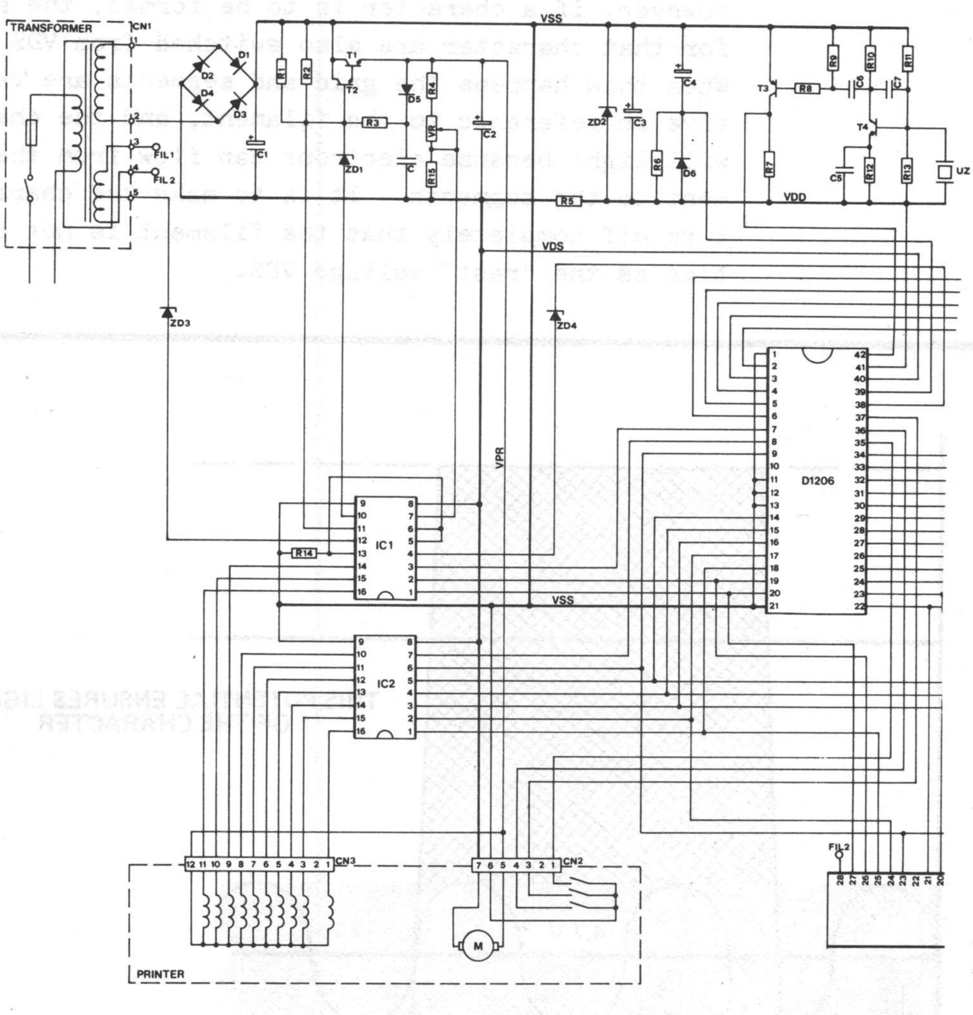
Note: The connection of the center-tap is via pin 12 of IC1. When not printing, pin 12 is internally connected to VDS, the most negative voltage.

⑭ With all voltages present, the scan or a character is as follows: "rest" voltage is VDS for both the grid and the segments; electrons will not flow from the filament to the segments because both the grid and the segments are "more negative" than the filament. The character remains dark. As the display is scanned, the character grids are sequentially switched from VDS to VSS (the output voltage or logic high level of the MOS device) and back to VDS.

However, if a character is to be formed, the segments for that character are also switched from VDS to VSS. When this happens the grid and segments are very positive in reference to the filament, and the character will light because electrons can flow from the filament to the segments. It is to make the characters turn off completely that the filament is not as negative as the "rest" voltage VDS.


VSS
(0 VOLTS)
VDD
(–10VDC)
THIS POTENTIAL ENSURES LIGHTING OF THE CHARACTER
4.7 V
FILAMENT
(–25 VDC)
VDS
(–30.0 VDC)
THIS POTENTIAL ENSURES COMPLETE TURN–OFF OF THE CHARACTER

⑮ Finally, a circuit is provided to turn off the display while the calculator is printing. This prevents electronic "noise" from appearing in the display, which could be distracting to the operator. Pin 38 of the MOS/LSI device, in addition to beginning the print cycle, also turns off the display during the print cycle, via segment pin 5/pin 12 of IC1, as follows:



When CMO (pin 38, Print Start) goes high to pin 4 of IC1, its output pin 13 is switched low. This low level is present at pins 5 and 6, causing them to switch their outputs high (pins 11 and 12). Connecting a high level to the filament center-tap disrupts the relationship of voltages previously described, and the display is turned off.

R.E.D. Procedures

This portion of the Technical Manual contains all facets of R.E.D. and all remaining electronic repairs to be performed by the technician.

The R.E.D. technician may not only locate and replace faulty discrete components, but IC and MOS devices as well. This is possible without the use of an oscilloscope because of an extensive fault-finding guide, located in this portion of the manual. This fault-finding guide will allow the technician to replace the most probable faulty component first, according to the malfunctions observed by the technician.

After performing the general test and a failure occurs, it is always advisable to check the voltages VSS, VDD, VPR and VDS, using the 1L section. If a fault is found in one of these, then consult the portion of the fault-finding guide pertaining to the power supply, Power-On initialize and motor circuits.

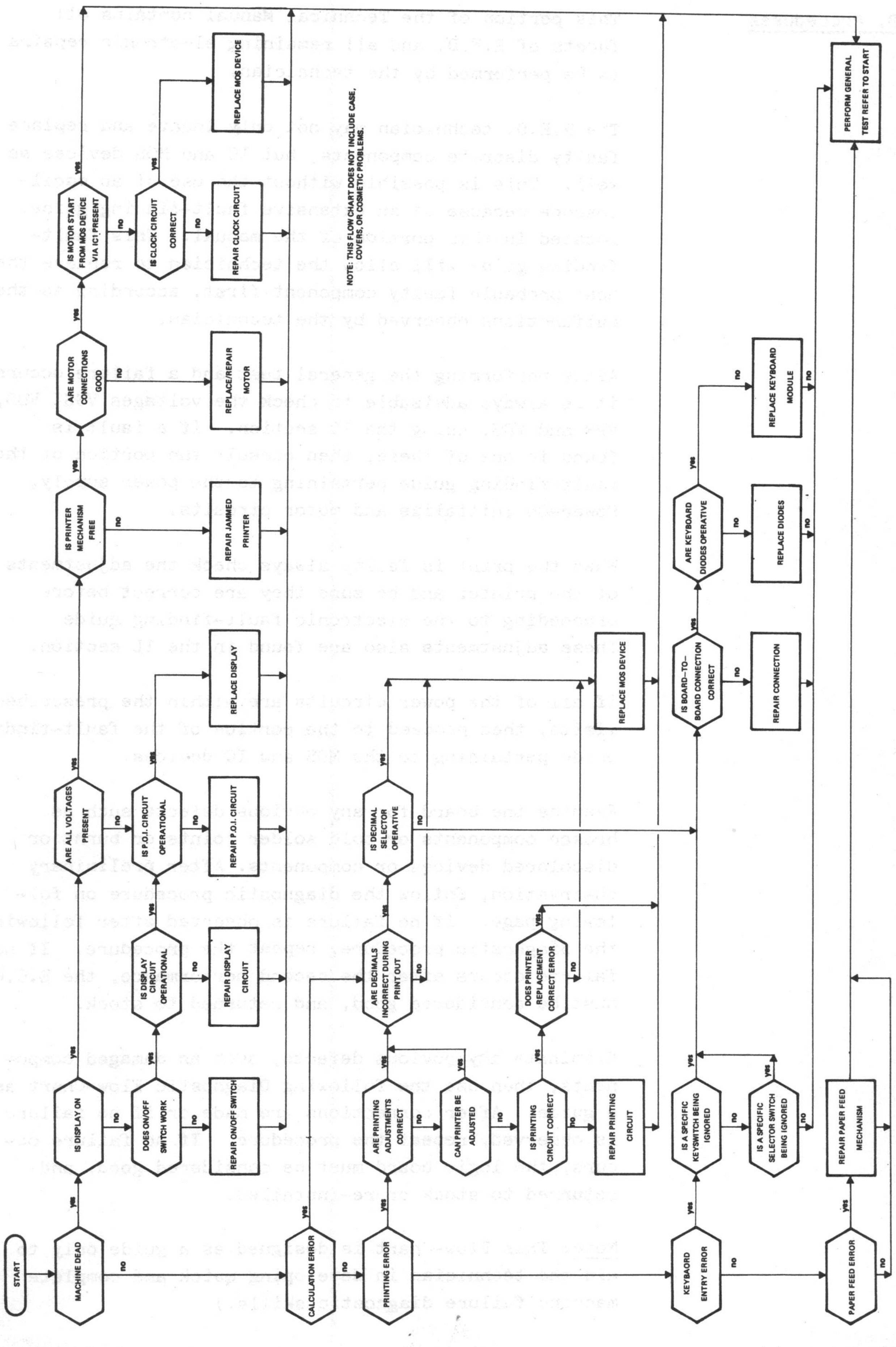
When the print is faulty always check the adjustments of the printer and be sure they are correct before proceeding to the electronic fault-finding guide. These adjustments also are found in the 1L section.

If all of the power circuits are within the prescribed limits, then proceed to the portion of the fault-finding guide pertaining to the MOS and IC devices.

Examine the board for any obvious defects such as broken components or cold solder joints or burnt or discolored devices or components. After preliminary observation, follow the diagnostic procedure on following page. If no failure is observed after following the diagnostic procedure, repeat the procedure. If no failure occurs after the second performance, the E.C.C. must be considered good, and returned to stock.

Eliminate any obvious defects, such as damaged components, then use the following Diagnostic Flow-Chart as a guide. After corrections are made or if no failure is observed, repeat the procedure. If no failure occurs, the logic board must be considered good, and returned to stock or re-installed.

Note: This Flow-Chart is designed as a guide only to aid the technician in developing quick and complete machine failure diagnostic skills.)


START
MACHINE DEAD
IS DISPLAY ON
DOES ON/OFF SWITCH WORK
REPAIR ON/OFF SWITCH
IS DISPLAY CIRCUIT OPERATIONAL
REPAIR DISPLAY CIRCUIT
ARE ALL VOLTAGES PRESENT
IS P.O.I. CIRCUIT OPERATIONAL
REPAIR P.O.I. CIRCUIT
REPLACE DISPLAY
IS PRINTER MECHANISM FREE
REPAIR JAMMED PRINTER
ARE MOTOR CONNECTIONS GOOD
REPLACE/REPAIR MOTOR
IS MOTOR START FROM MOS DEVICE VIA IC1 PRESENT
IS CLOCK CIRCUIT CORRECT
REPAIR CLOCK CIRCUIT
REPLACE MOS DEVICE
CALCULATION ERROR
PRINTING ERROR
ARE PRINTING ADJUSTMENTS CORRECT
CAN PRINTER BE ADJUSTED
IS PRINTING CIRCUIT CORRECT
REPAIR PRINTING CIRCUIT
ARE DECIMALS INCORRECT DURING PRINT OUT
DOES PRINTER REPLACEMENT CORRECT ERROR
ARE DECIMALS SELECTOR OPERATIVE
REPLACE MOS DEVICE
KEYBAORD ENTRY ERROR
IS A SPECIFIC KEYSWITCH BEING IGNORED
IS A SPECIFIC SELECTOR SWITCH BEING IGNORED
IS BOARD-TO-BOARD CONNECTION CORRECT
REPAIR CONNECTION
ARE KEYBOARD DIODES OPERATIVE
REPLACE DIODES
REPLACE KEYBOARD MODULE
PAPER FEED ERROR
REPAIR PAPER FEED MECHANISM
PERFORM GENERAL TEST REFER TO START
yes
no

NOTE: THIS FLOW CHART DOES NOT INCLUDE CASE, COVERS, OR COSMETIC PROBLEMS.

Power Supply Faults

During the fault analysis, the technician should use VSS (0 Volts) as system ground, or reference, for all checks. This is most easily accomplished by using a clip-lead on the positive (+) lead of the large capacitor, C1. Also, a continuity check on VSS is recommended before beginning the analysis. Note that resistor R5 gets hot: this is normal.

FAULT	PROBABLE CAUSE
VDS (approximately -30 VDC)	
VDS is 0 Volts	no AC line voltage to transformer; fuse blown; transformer faulty.
VDS is approx. -20 VDC	ZD2 faulty; short between VDS and VSS; transformer faulty; rectifier diode(s) D1,D2,D3 or D4 faulty.
VDD (-10 VDC)	
VDD is 0 Volts	ZD2 short; C3 short; R5 open; short between VDD and VSS.
VDD is less than -9 VDC or greater than -11 VDC	ZD2 faulty.
P.O.I. (-8.5 to -9.5 VDC)	
P.O.I. is 0 Volts	C4 short.
P.O.I. is correct voltage, but P.O.I. does not occur reliably	R6 or D6 short.

Motor Circuit Faults

During the fault analysis, if the technician determines that the fault is in the motor circuit, first check VSS, VDS and VDD to determine that all other required voltages are present.

As the motor circuit is controlled by the MOS/LSI device, it is logical to check its output first, then the driver IC1. Remember to use VSS as reference.

STEP *	Component	Pin or lead	CORRECT VOLTAGE OF SIGNAL At Rest	 Printing
1	MOS/LSI	pin 38	-20 VDC	0 Volts
2	IC1	pin 4	-28 to -29 VDC	-10 to -12 VDC
3	IC1	pins 13,5,6	-15 to -16 VDC	-27 to -28 VDC
4	IC1	pin 11	-30 VDC	-10 to -12 VDC
5	IC1	pin 10	-30 VDC	-16 to -17 VDC
6	T2	emitter	-30 VDC	-10 to -12 VDC
7	T2	base	-30 VDC	-10 to -12 VDC
8	T1	base	-30 VDC	-10 to -12 VDC
9	T1	emitter	-30 VDC	-10 to -12 VDC

Note: (*) Follow these steps in the sequence presented.

VPR Table of Motor Circuit Faults

Electronic Display Faults

Fault	Probable cause
no display	ZD3 open; IC1 faulty - check pin 12: approximately -29 VDC is correct; filament open - continuity check with power supply disconnected should be 50 to 60 Ohms
display flickers	ZD3 short
display fails to turn off during print	pin 5/pin 12 segment of IC1 faulty

MOS/LSI Device Open-pin Faults

PIN	FAULT
1	No effect
2	NOT-PRINT, ACC, R/O selectors fail
3	7,8,9,0,00,000,⊙,CE:CA keys; TIME and DATE positions fail (L62 only)
4	△,x,÷,%,GT,CNT,T2,S2 keys; DECIMAL @ +,4, 6 fail
5	=, +1,-1,T1,S1,R,GM,+2,-2 keys; DECIMAL @ 2, 6; TIME fails (L62 only)
6	1, 2, 3, 4, 5, 6,⊖ keys; DECIMAL @ +, FL fail
7	No print in 5th and 6th positions
8	No print in 7th and 8th positions
9	No DP segments; no print in 9th and 10th positions
10	No effect
11	No effect
12	No effect
13	All functions confused, intermittent display
14	No G segments, no print in 11th and 12th positions
15	No F segments, no print in 13th and 14th positions
16	No E segments, no print in 15th and 16th positions
17	No D segments, no print in 17th and 18th positions
18	No C segments, no print in 19th and 20th positions
19	No B segments, no print in 3rd and 4th positions
20	No A segments, no print in 1st and 2nd positions
21	No effect
22	No display in 1st position; △, =, 7 keys fail
23	No display in 2nd position; 1, 8, x, +1 keys fail
24	No display in 3rd position; 2, 9, ÷, -1 keys fail
25	No display in 4th position; 3, 0, %, T1 keys fail; extra character in 7th position of display
26	No display in 5th position; 4, 00, S1, GT keys fail; PRINT/non-PRINT selector fails in non-PRINT position
27	No display in 6th position; 5, 000, R, CNT keys fail; CE:CA does not clear
28	No display in 7th position; 6,⊙, #, GM keys fail; ACC (accumulate) position fails
29	No display in 8th position;⊖, +2, T2, CE:CA keys fail; R/O @ 9 position fails
30	No display in 9th position; -2, S2 keys fail; R/O @ 5 fails
31	No display in 10th position; all DECIMAL positions = zero
32	No display in 11th position
33	No display in 12th position
34	No display in 13th position
35	Printer runs continuously, no print
36	Printer runs continuously, no print
37	Printer runs continuously, no print
38	**Machine dead**

39	Machine dead
40	Entire display lit; machine may print nonsense dots
41	Machine dead
42	Printer runs continuously, no print

General Test,
LOGOS 46PD, 48, 49

Begin test with selectors at: PRINT, ACC, R/O=0,
CALC*, DEC=+   Turn calculator ON. *LOGOS 49 only.
**Not for LOGOS 46PD

```
                                         0,00 C
                                                    linespace
81 81 81 81 81 81 +     8 181 818 181,81 +1
                  +     8 181 818 181,81 E1
                                  ERROR             overflow
                                                    linespace
          CE:CA   +     8 181 818 181,81 E1
                                  ERROR             overflow
                                                    linespace
          CE:CA   T     8 181 818 181,81 T+1        auto accum.
                                                    linespace
70707070707       +       707 070 707,07 +1
                  T       707 070 707,07 T+1        auto accum.
                                                    linespace
             GT   S     8 888 888 888,88 S3
                                                    linespace
                  ÷     8 888 888 888,88 ÷
              9   =                 0,09 =
                        98 765 432 098,6 E
                                  ERROR             overflow
                                                    linespace
       CE:CA GT   T     8 888 888 888,88 T3
                                                    linespace
123.456.GT 789    +             123,456789 +1       GT,2nd dec. ignored
                  T                 123,45 T+1      auto accum.
                                           ↓        result rounded down
             GT   T                 123,45 T3
                                                    linespace
                  △                 123,45 △
          11111   =                 111,11 =
                                    -12,34 △T+      auto accum.
                                     -9,99 △%
                                           ↓
        * *   .1  R/O                  0,1 R
                                                    linespace
R/O=9,DEC=2:  145 ÷                 145,00 ÷
            (-)12 =                 -12,00 =
                                    -12,09 T        normal round-off
        * *                         -12,10 RT+      parametric round-off
        * *                                ↑R       result rounded up
R/O=5:          1 ÷                   1,00 ÷
                9 =                   9,00 =
                                      0,11 T        normal round-off
                                      0,10 RT+      parametric round-off
        * *                                ↓R       result rounded down
```

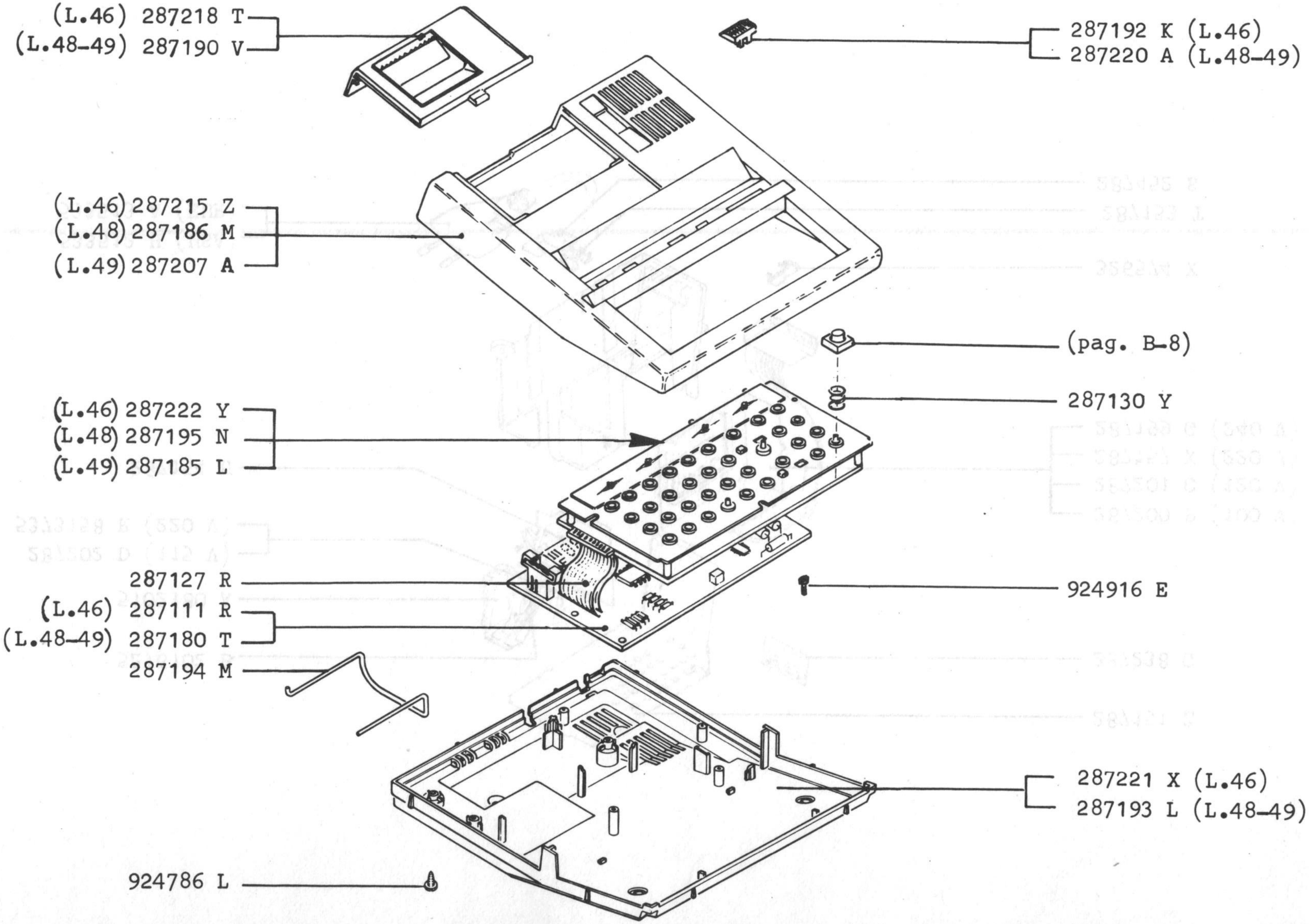
```
DEC=FL:       * *   .5  R/O                0.5 R
                                                    linespace
                     4  ÷                    4 ÷
                     7  =                    7 =
                                 0.57142857142 ↧    auto accum.
                                                    linespace
                        +        0.57142857142 +1
DEC=6:                  T             0.571429 T1
              * *                     0.500000 R↧   rounded result
              * *                    -0.071429 AD   difference
                                               ↓    result rounded down
DEC=4,R/O=9:       GT   T             -23.2686 T3
              * *                     -23.5000 RT   rounded result
              * *                      -0.2314 AD   difference
                                               ↑    result rounded up
DEC=2:        * *       R/O                0.5 R    recalled value
                                                    linespace
              * *   27  GM               27.00 M
              * *  161  =               161.00 =
              * *                       220.55 T
              * *                       221.00 RT
                                               ↑R   result rounded up
(L46PD only: enter 221)△                221.00 △
                   225  =               225.00 =
                                          4.00 △↧   auto accum.
                                          1.81 △%
                                               ↑    result rounded up
                   GT   S                 4.00 S3
                                                    linespace
                        x                 4.00 ×
                        ÷                 4.00 ÷
                        %                 4.00 %
                                        400.00 T
                                        400.00 R↧
                                                    linespace
                        x               400.00 ×
                        ÷               400.00 ÷
                        %               400.00 %
                                     40 000.00 T
                                     40 000.00 R↧
                                                    linespace
                   123  +               123.00 +1
                        +               123.00 +1
                        +               123.00 +1
                        T               369.00 T1
                                        369.00 R↧   rounded total
                                             0 AD
                                                    linespace
```

```
                      CNT        003        CNT  1
                      CNT                   123.00 AM     auto average
                                                          linespace
                      GT  T              40 773.00 T3
                                         40 773.00 RT     rounded total
                                                 0 AD
                                                          linespace
                      CNT        004        CNT  3
                      CNT                10 193.25 AM
                                                          linespace
ACC=OFF:  CE:CA, CE:CA                        0.00 C      machine clear
                                                          linespace
                           x                       x
                           =                       =      2 key sequence
                                                          linespace
                      23   +                 23.00 x
                      56   +                 56.00 =
                                          1 288.00 T
                                                          linespace
                      14   +                 14.00 x
                      25   +                 25.00 =
                                            350.00 T
                                                          linespace
                           +                350.00 x
                           +                350.00 =
                                        122 500.00 T
                                                          linespace
PRINT=OFF,DEC=0      456   +                   456        display only
                           +                207936        display only
                           T                     0        display only
              2 00 3 000 #               2 003 000 #
PRINT=ON,DATE: CE:CA,CE:CA                       0 C      machine clear
                                                          linespace
              1.1.1977 +               1.01.1977 D
                   358 =                DAYS
                                               358 +
                                      12.25.1977 D2
                                        SUN        7
                                                          linespace
TIME:               7.29 +               7.29.00 TI
                   12.01 =              12.01.00 TO
                                         4.32.00 +1
                                                          linespace
                   12.30 +              12.30.00 TI
                   16.1  =              16.01.00 TO
                                         3.31.00 +1
                                                          linespace
```

Only for L.49

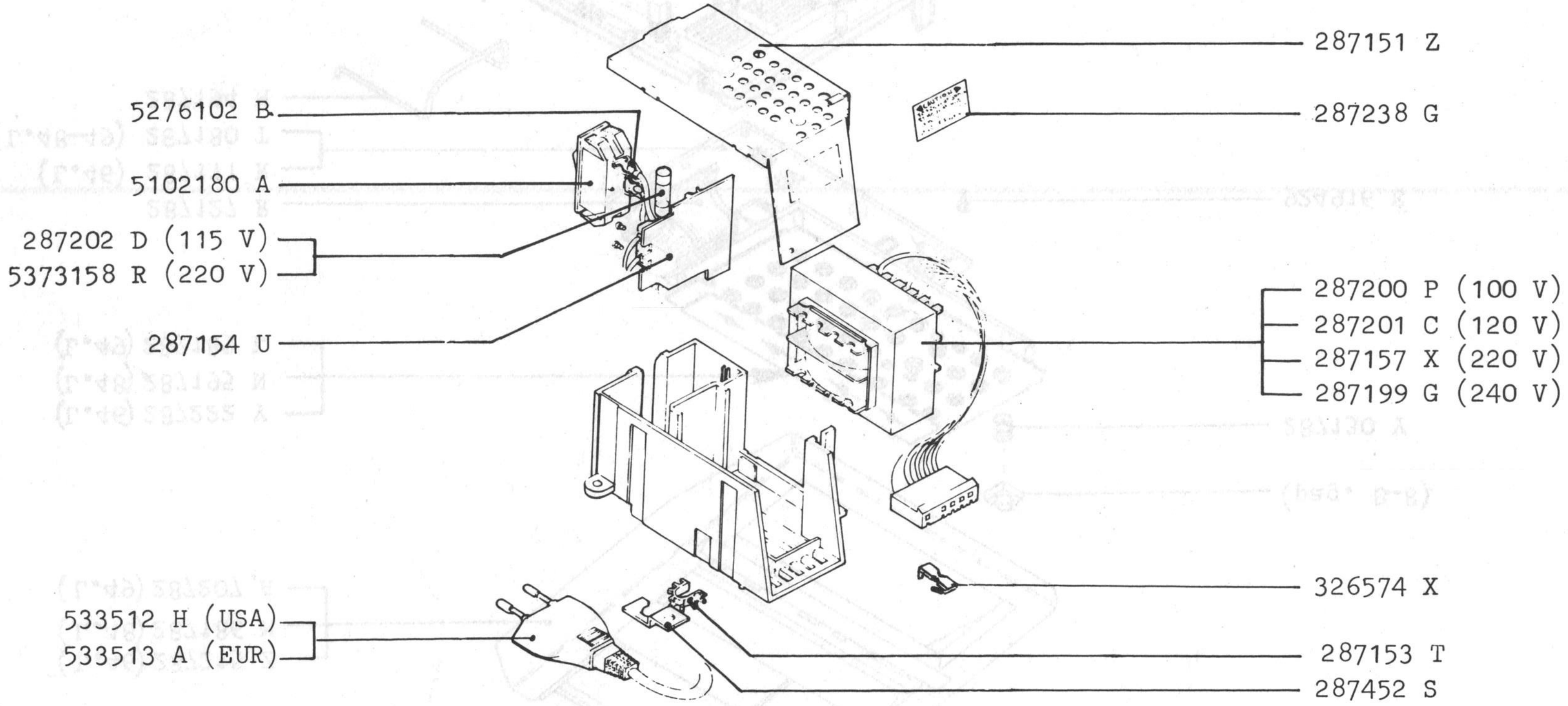
```
                        T          8.03.00 T1   linespace
CALC: (2nd register) +                  0 +2   no transfer from TIME
                    55 +               55 +2
                    66 -               66 -2
                       -               66 -2
                       S              -77 S2   linespace
                       T              -77 T2   linespace
                     CNT     000     CNT 2
                     CNT             ERROR     logical error
                                               linespace
END OF TEST
```

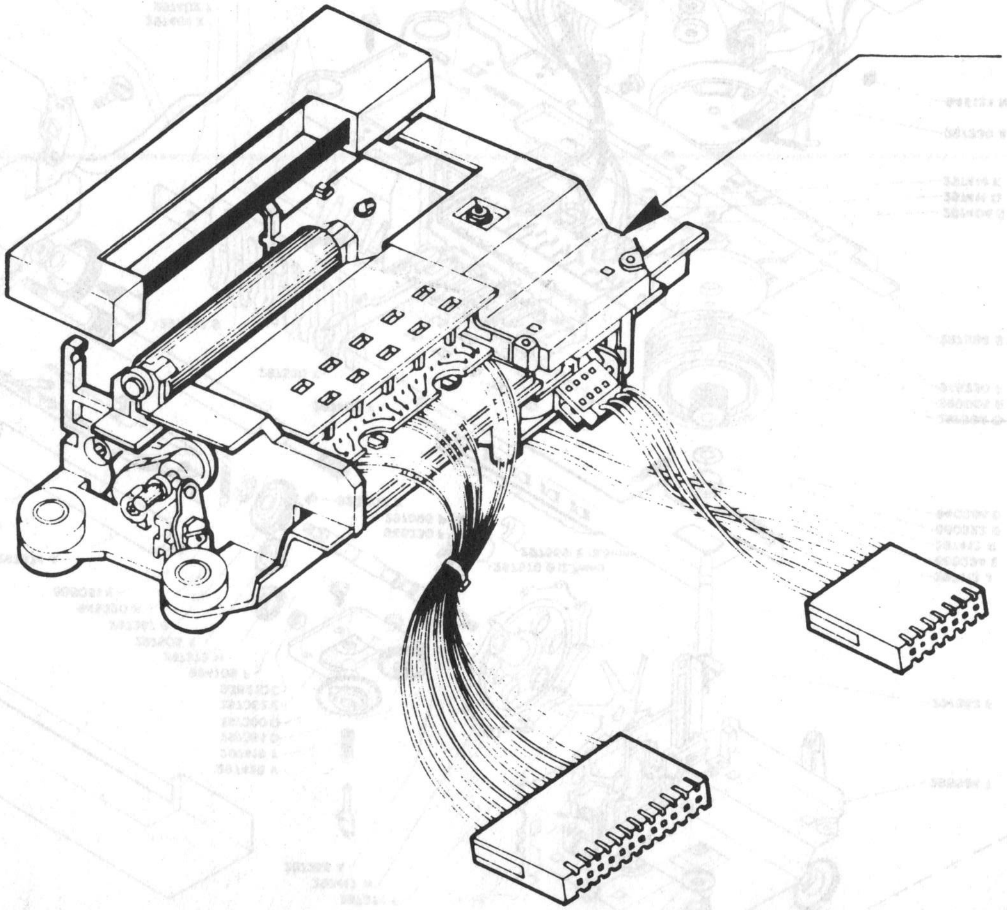
B. UNIT PARTS LIST

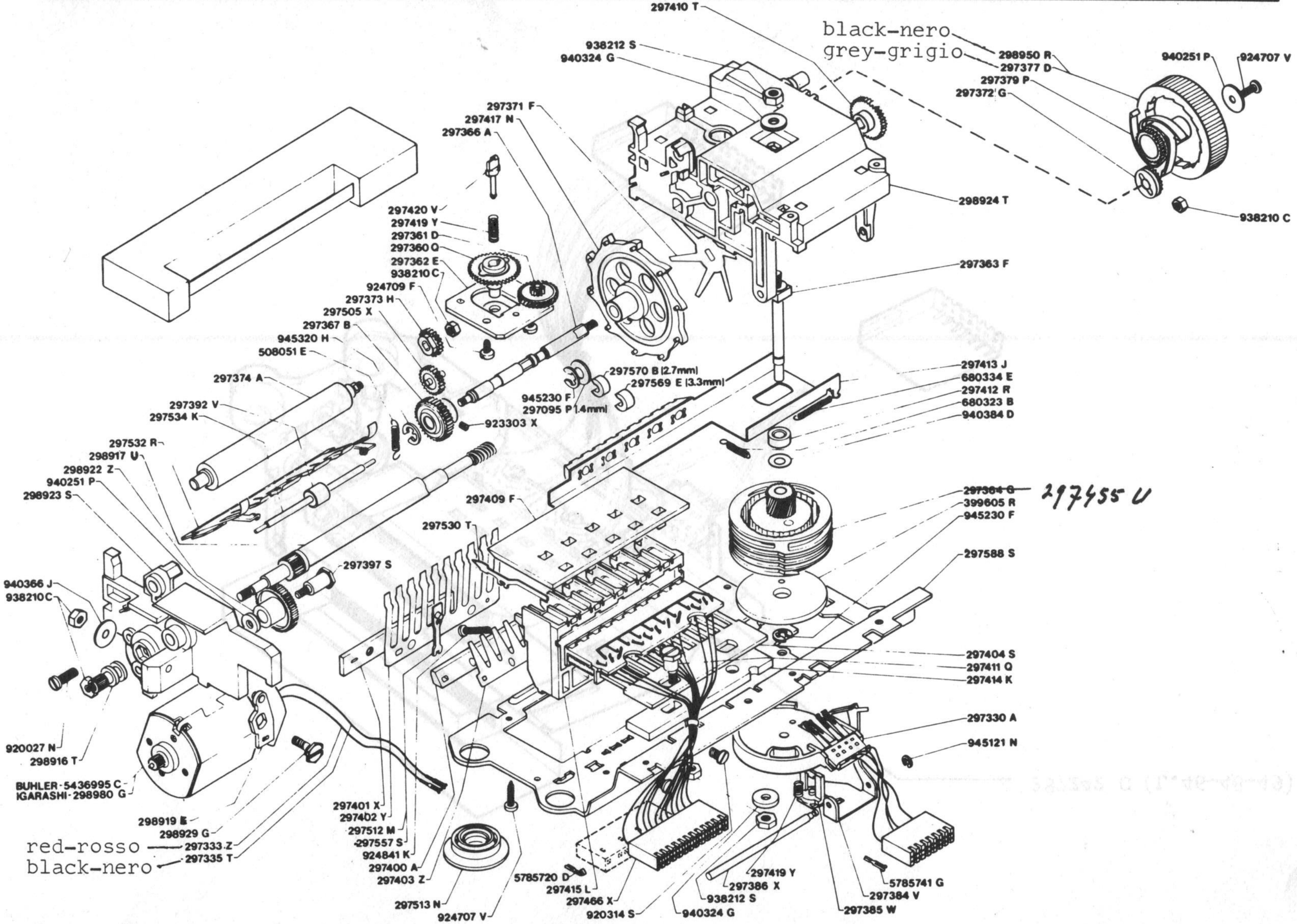

(L.46) 287218 T
(L.48–49) 287190 V
287192 K (L.46)
287220 A (L.48–49)
(L.46) 287215 Z
(L.48) 287186 M
(L.49) 287207 A
(pag. B–8)
287130 Y
(L.46) 287222 Y
(L.48) 287195 N
(L.49) 287185 L
287127 R
924916 E
(L.46) 287111 R
(L.48–49) 287180 T
287194 M
287221 X (L.46)
287193 L (L.48–49)
924786 L

TRASFORMATORE

TRANSFORMER



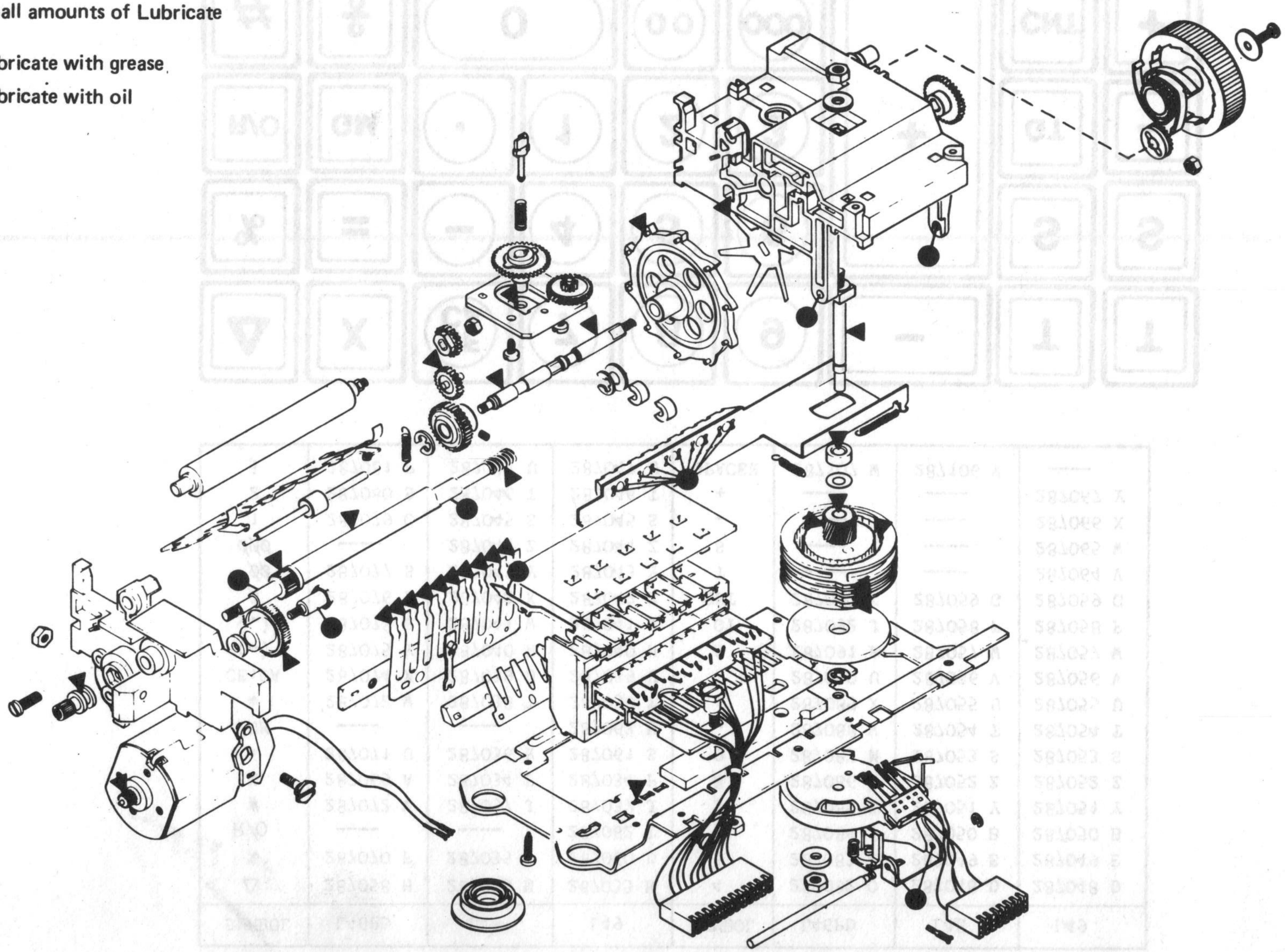

287242 C (L.46-48-49)


297410 T
938212 S
940324 G
black-nero
grey-grigio
298950 R
297377 D
297379 P
297372 G
940251 P
924707 V
298924 T
938210 C
297371 F
297417 N
297366 A
297420 V
297419 Y
297361 D
297360 Q
297362 E
938210 C
924709 F
297373 H
297505 X
297367 B
945320 H
508051 E
297374 A
297392 V
297534 K
297363 F
297570 B (2.7mm)
297569 E (3.3mm)
945230 F
297095 P (1.4mm)
923303 X
297413 J
680334 E
297412 R
680323 B
940384 D
297532 R
298917 U
298922 Z
940251 P
298923 S
297409 F
297530 T
~~297384 G~~ 297455 U
399605 R
945230 F
297588 S
297397 S
940366 J
938210 C
297404 S
297411 Q
297414 K
297330 A
945121 N
920027 N
298916 T
BUHLER - 5436995 C
IGARASHI - 298980 G
298919 E
298929 G
red-rosso
black-nero
297333 Z
297335 T
297401 X
297402 Y
297512 M
297557 S
924841 K
297400 A
297403 Z
297513 N
924707 V
5785720 D
297415 L
297466 X
920314 S
297419 Y
297386 X
938212 S
940324 G
5785741 G
297384 V
297385 W

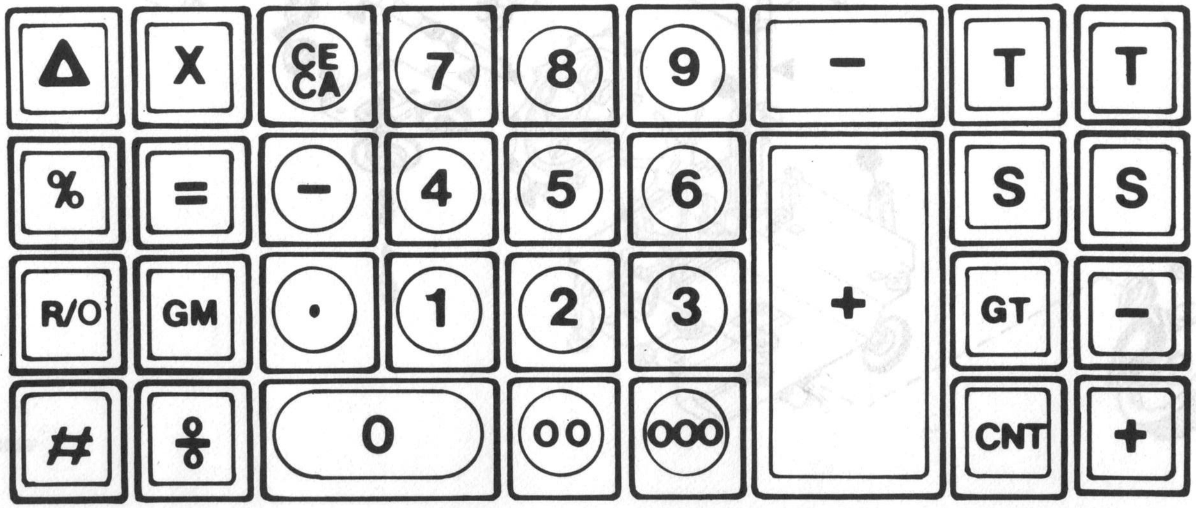
Use small amounts of Lubricate

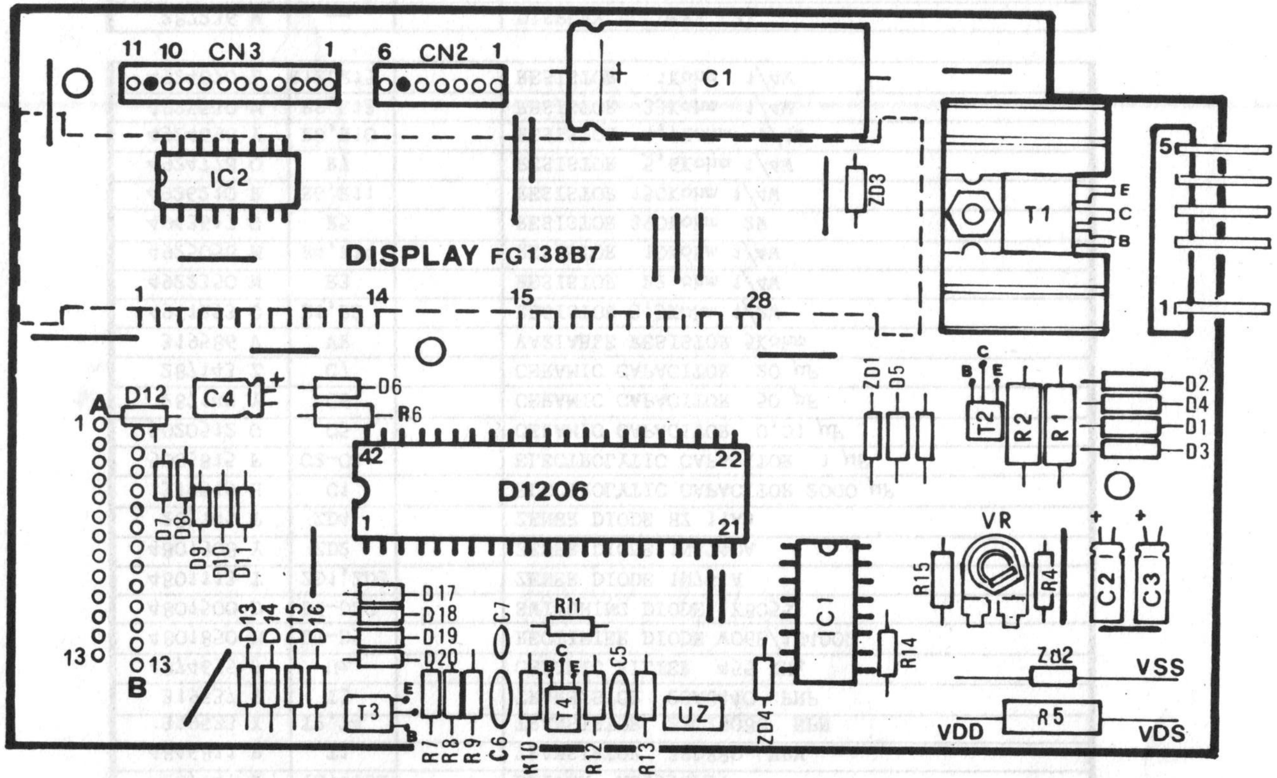
▼ Lubricate with grease

● Lubricate with oil



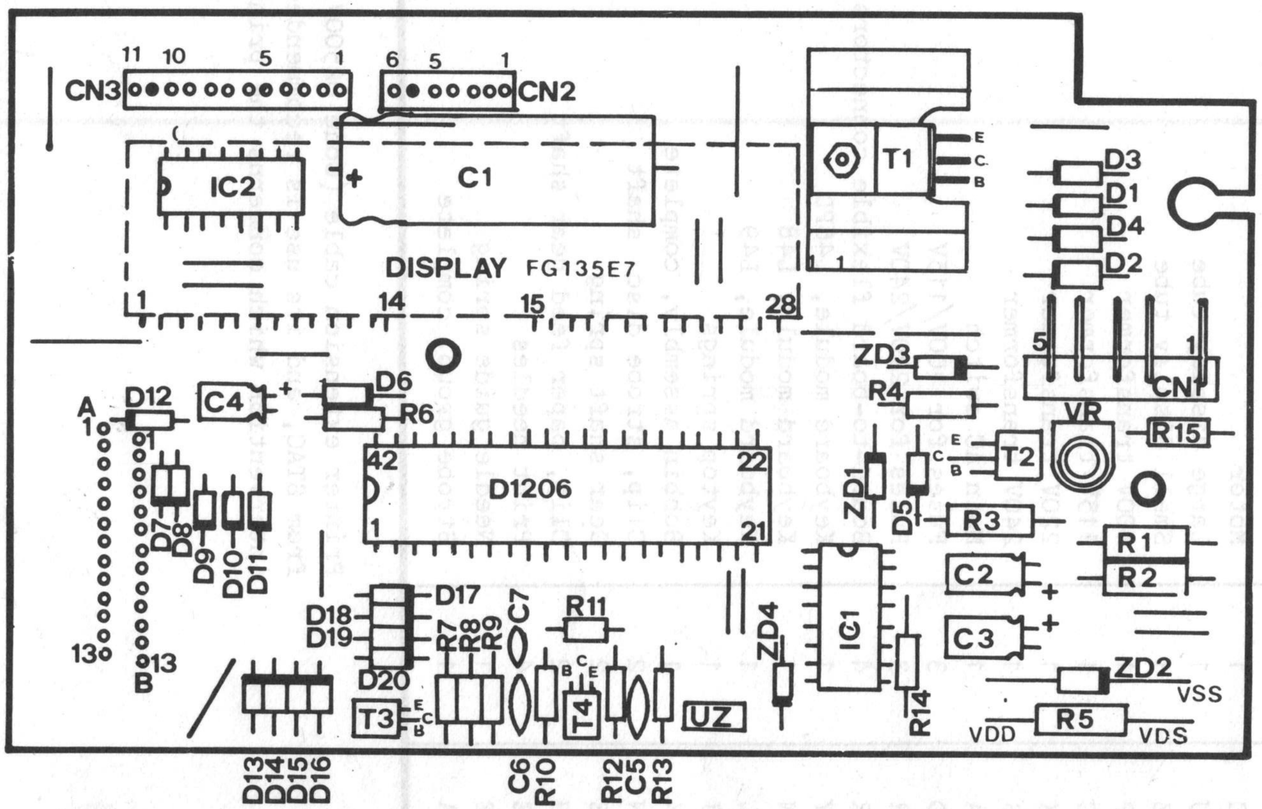
SYMBOL	L46PD	L48	L49	SYMBOL	L46PD	L48	L49
△	287058 H	287033 N	287033 N	4	287082 Q	287048 D	287048 D
%	287070 F	287035 Q	287060 D	5	287083 R	287049 E	287049 E
R/O	----	----	287062 T	6	287084 J	287050 B	287050 B
#	287072 V	287037 J	287037 J	7	287085 K	287051 Y	287051 Y
X	287069 A	287034 P	287034 P	8	287086 L	287052 Z	287052 Z
=	287071 U	287036 R	287061 S	9	287087 M	287053 S	287053 S
GM	----	----	287063 U	-	287088 W	287054 T	287054 T
÷	287072 W	287038 T	287038 T	+	287089 X	287055 U	287055 U
CE:CA	287074 X	287039 U	287039 U	T	287090 U	287056 V	287056 V
(-)	287075 Y	287040 H	287040 H	S	287091 R	287057 W	287057 W
(.)	287078 B	287041 W	287041 W	GT	287092 J	287058 F	287058 F
0	287076 Z	287042 X	287042 X	CNT	287093 K	287059 G	287059 G
00	287077 S	287043 Y	287043 Y	T	----	----	287064 V
000	----	287044 Z	287044 Z	S	----	----	287065 W
1	287079 C	287045 S	287045 S	-	----	----	287066 X
2	287080 S	287046 T	287046 T	+	----	----	287067 Y
3	287081 P	287047 U	287047 U	SPACER	287107 W	287106 V	----





Code vedi pag. see page B-10

Codice *Code number*	Rifer. *Ref.*	Quant. *Q.ty*	Descrizione *Description*
4863989 X	D1206		N.E.C. MOS/LSI
287138 U	(L.46)		FG 138B7 DISPLAY
287198 Z	(L.48-49)		FG 135E7 DISPLAY
287141 X	IC1-1C2		DRIVER MC4530/31
4846811 P	T1		TRANSISTOR 2SD880 NPN
319533 X	T2,T4		TRANSISTOR 2SC2308C NPN
319537 T	T3		TRANSISTOR 2SA844C PNP
4874655 J	Uz		CERAMIC FILTER 455 KHz
4801850 M	D1-D5		RECTIFIER DIODE W06B/1N4002
4801500 D	D6-D20		SWITCHING DIODE 1X8055
4801113 T	ZD1,ZD3		ZENER DIODE 1N751A
4801308 Y	ZD2		ZENER DIODE 1N4740A
287145 T	ZD4		ZENER DIODE HZ 11A3
319519 H	C1		ELECTROLYTIC CAPACITOR 2000 µF
5003815 F	C2-C4		ELECTROLYTIC CAPACITOR 1 µF
5020512 G	C5		CERAMIC CAPACITOR 0,01 µF
287142 Y	C6		CERAMIC CAPACITOR 50 µF
287143 Z	C7		CERAMIC CAPACITOR 20 µF
319586 V	VR		VARIABLE RESISTOR 5Kohm
4911253 Q	R1,R2		RESISTOR 3,3Kohm 1/2W
4922350 N	R3		RESISTOR 22 ohm 1/4W
4925058 M	R4,R14		RESISTOR 10Kohm 1/4W
4943617 G	R5		RESISTOR 390Kohm 2W
4926210 R	R6,R11		RESISTOR 150Kohm 1/4W
4924778 Q	R7		RESISTOR 5,6Kohm 1/4W
4924698 Y	R8,R10		RESISTOR 4,7Kohm 1/4W
4925530 M	R9,R13		RESISTOR 33Kohm 1/4W
4924070 L	R12,R15		RESISTOR 1Kohm 1/4W
287236 W	--		DISPLAY HOLDERS (2)
295546 V	--		HEAT SINK FOR T1
920012 P	--		SCREW FOR HEAT SINK
938212 S	--		NUT FOR HEAT SINK
287148 E	--		POWER SUPPLY CONNECTOR
5785740 F	--		STROBE CONNECTOR, PRINTER
5785742 L	--		BOBBIN CONNECTOR, PRINTER



PIASTRA L. 48 - 49

BOARD L. 48 - 49

Recommended Part List

PART NUMBER	QTY	DESCRIPTION
297305 E	1	Complete printer group
287111 R	1	Logic board assy (NEC), large display
287180 T	1	Logic board assy (NEC), small display
5436995 C	1	Motor
287138 U	1	Large display tube
287198 Z	1	Small display tube
287200 P	1	100V transformer
287201 C	1	115V transformer
287157 X	1	220V transformer
287199 S	1	240V transformer
5102180 A	1	Main AC switch
287202 D	3	Fuses for 100V/115V
5373158 R	3	Fuses for 220V/240V
287127 R	4	Board-to-board flexible connectors
287222 Y	1	Keyboard module, L46PD
287195 N	1	Keyboard module, L48
287185 L	1	Keyboard module, L49
297492 J	1	Keytop springs
297466 X	1	Bobbin assembly, complete
945121 N	2	Clip, strobe disc shaft
508051 E	2	Gear shaft spring
945320 H	2	Clip, paper feed gear shaft
297408 E	4	Print needles
680334 E	1	Needle guide spring
297330 A	1	Strobe group, complete

Printer extension cable (Code 025007 R) is available from STAC, and its use is recommended for any machine intervention which concerns the printer.